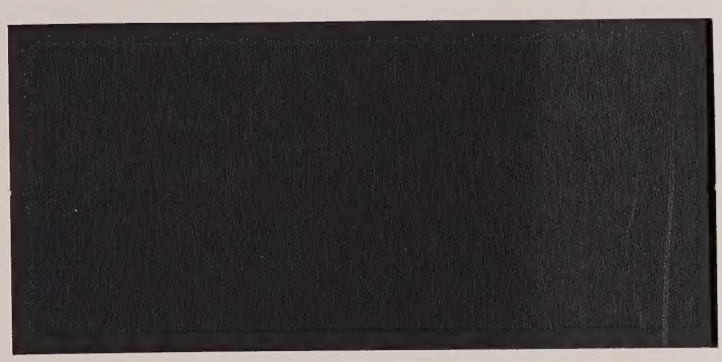

WAVETEK

SERVICE MANUAL

XT Series
DM23XT, DM25XT, DM27XT
Digital Multimeters

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Manual Revision A, 1/95
Manual Part Number 1000-1357-00

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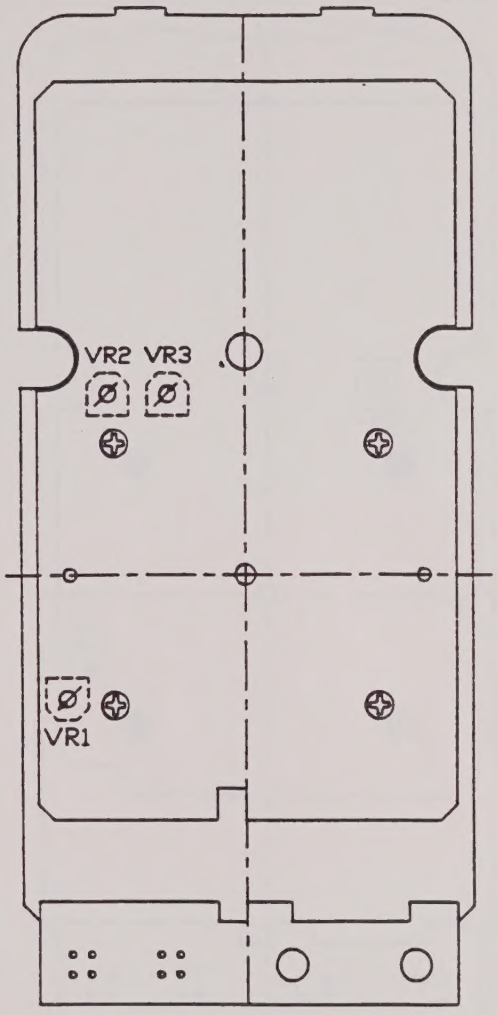
Calibration Procedure

DM23xt
DM25xt
DM27xt

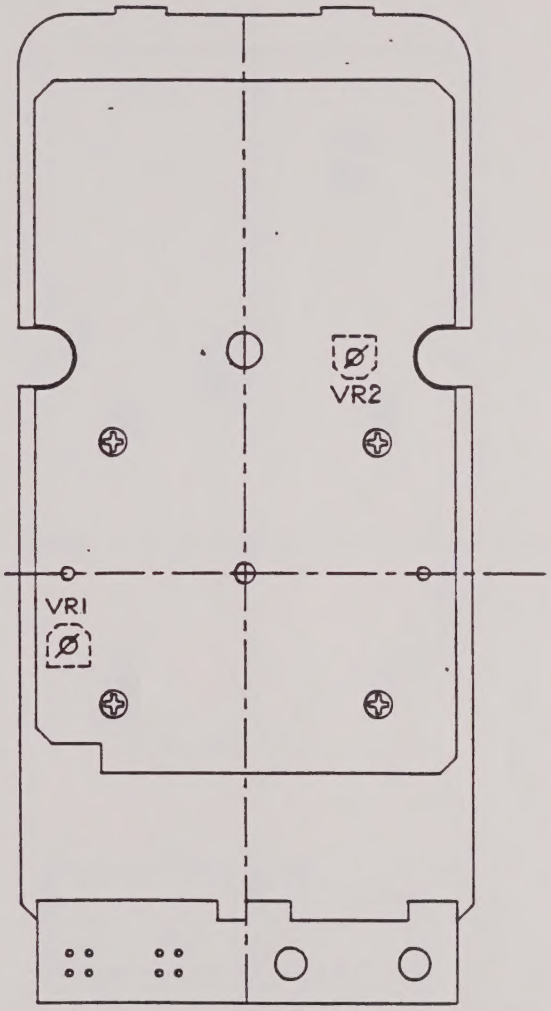
DM23xt CALIBRATION PROCEDURE



The procedure should be performed at an ambient temperature of 25°C±2°C, and at a relative humidity of less than 80%. . Allow the instrument to stabilize at this temperature for a minimum of 30 minutes.

1. Remove the back case screws, and carefully pry up the back case.
2. Set the Function/Range switch to the "200mV" position.
3. Set the DC/AC rubber botton to DC mode, See the left up corner of the display.
4. Set the output of the DC calibrator for 190.0mV±0.02% and connect it to the "VΩ" and "COM" input terminals.
5. Adjust VR1 until the display reads 190.0mV±1 digit.
6. Set the Function/Range switch to the "200°C" position.
7. Immerse the K type probes into ice point(OMEGA TRC-III) or ice water(A stabilized mixture of ice and water is very close to 0°C) and let them stabilize.
8. Immerse the K type thermocouple tip to the T/C socket, and wait for 3 minutes.
9. Adjust VR2 until the display reads 00.0°C±1 digit.
10. Set the Function/Range switch to the "200°F" position.
11. Adjust VR3 until the display reads 32.0°F±1 digit.

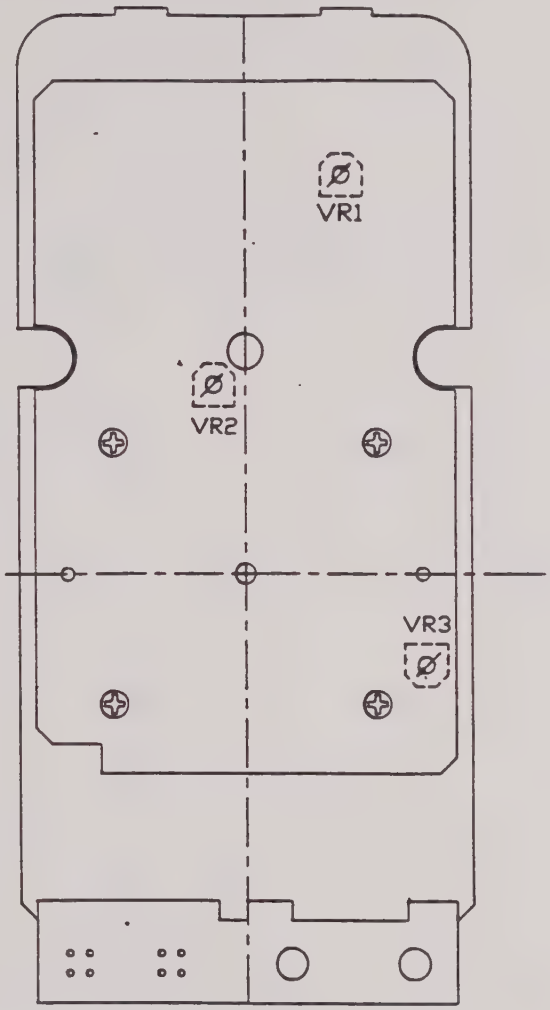
DM25xt CALIBRATION PROCEDURE



The procedure should be performed at an ambient temperature of 25°C±2°C, and at a relative humidity of less than 80%. Allow the instrument to stabilize at this temperature for a minimum of 30 minutes.

1. Remove the back case screws, and carefully pry up the back case.
2. Set the Function/Range switch to the "200mV" position.
3. Set the DC/AC rubber botton to DC mode, See the left up corner of the display.
4. Set the output of the DC calibrator for 190.0mV±0.02% and connect it to the "VΩ" and "COM" input terminals.
5. Adjust VR1 until the display reads 190.0mV±1 digit.
6. Set the function/Range switch to the "2kHz" position.
7. Set the output the of function generator for 1000Hz±0.02% and connect it to the "VΩ" and "COM" input terminals.
8. Adjust VR2 until the display reads 1000Hz±1 digit.

DM27xt CALIBRATION PROCEDURE

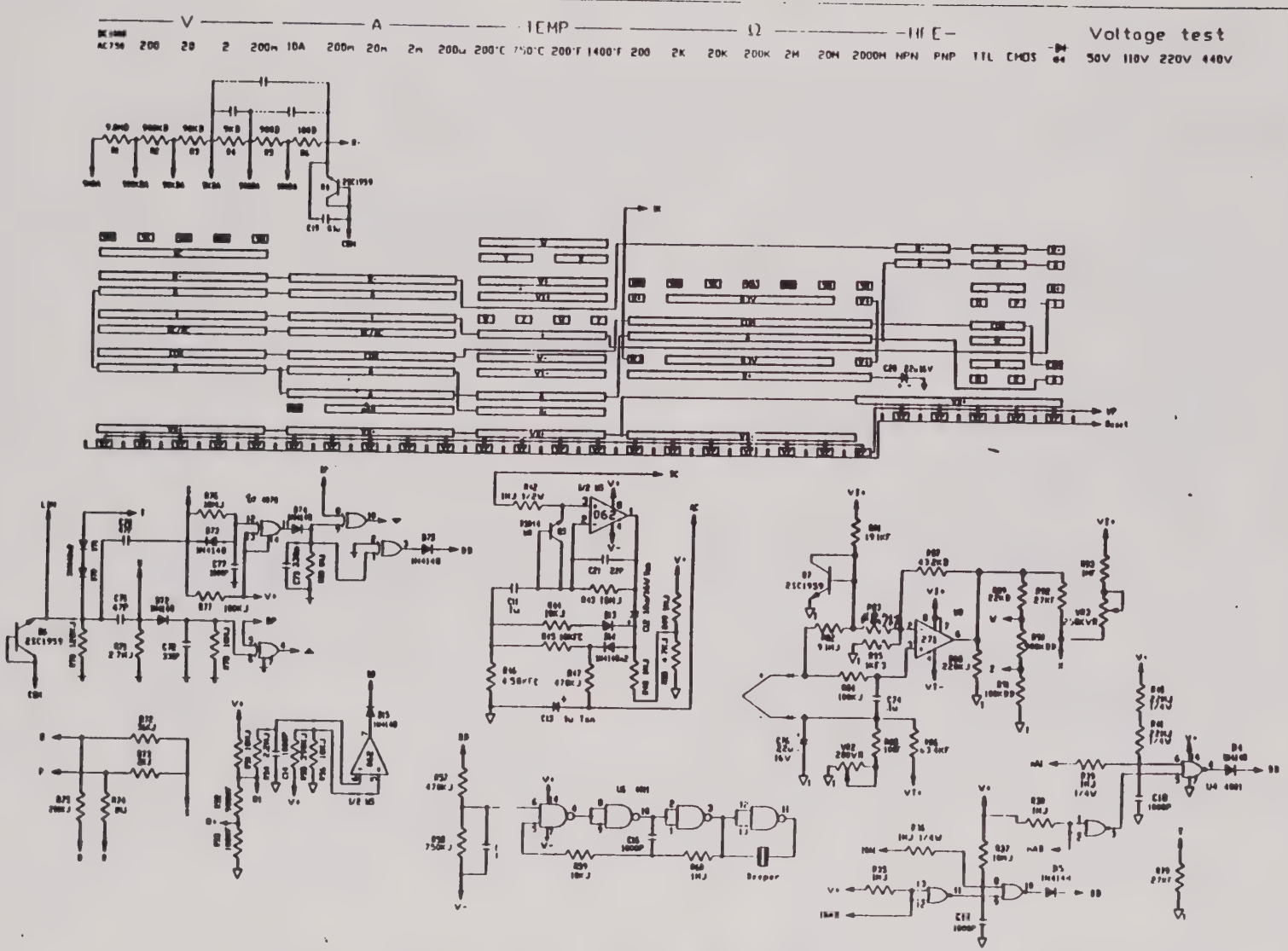


The procedure should be performed at an ambient temperature of 25°C±2°C, and at a relative humidity of less than 80%. Allow the instrument to stabilize at this temperature for a minimum of 30 minutes.

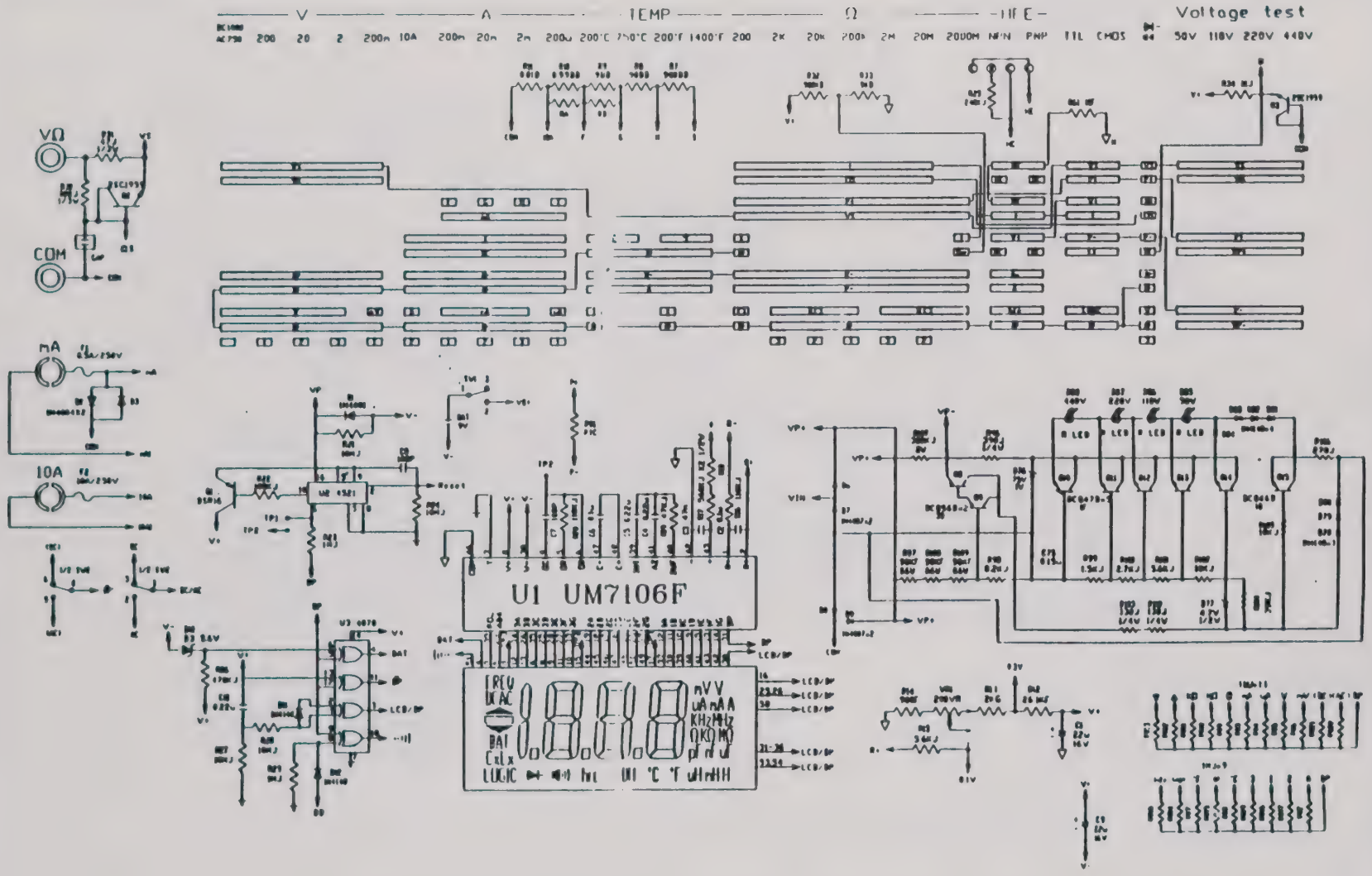
1. Remove the back case screws, and carefully pry up the back case.
2. Set the Function/Range switch to the "200mV" position.
3. Set the DC/AC rubber botton to DC mode, See the left up corner of the display.
4. Set the output of the DC calibrator for 190.0mV±0.02% and connect it to the "VΩ" and "COM" input terminals.
5. Adjust VR1 until the display reads 190.0mV±1 digit.
6. Set the Function/Range switch to the "2mH" position.
7. Adjust VR3 until the display reads 0.000
8. Set the Function/Range switch to the "2uF" position.
9. Get a 1.000uF±1nF standard capacitor or a stabilized metalize capacitor which value was selected close to 1uF, and the capacitor must be discharge before connecting.
10. Connect the capacitor to the "Cx" and "COM" input terminals.
11. Adjust VR2 until the display reads an identical value of standard capacitor or metalize capacitor.

Service For DM23xt

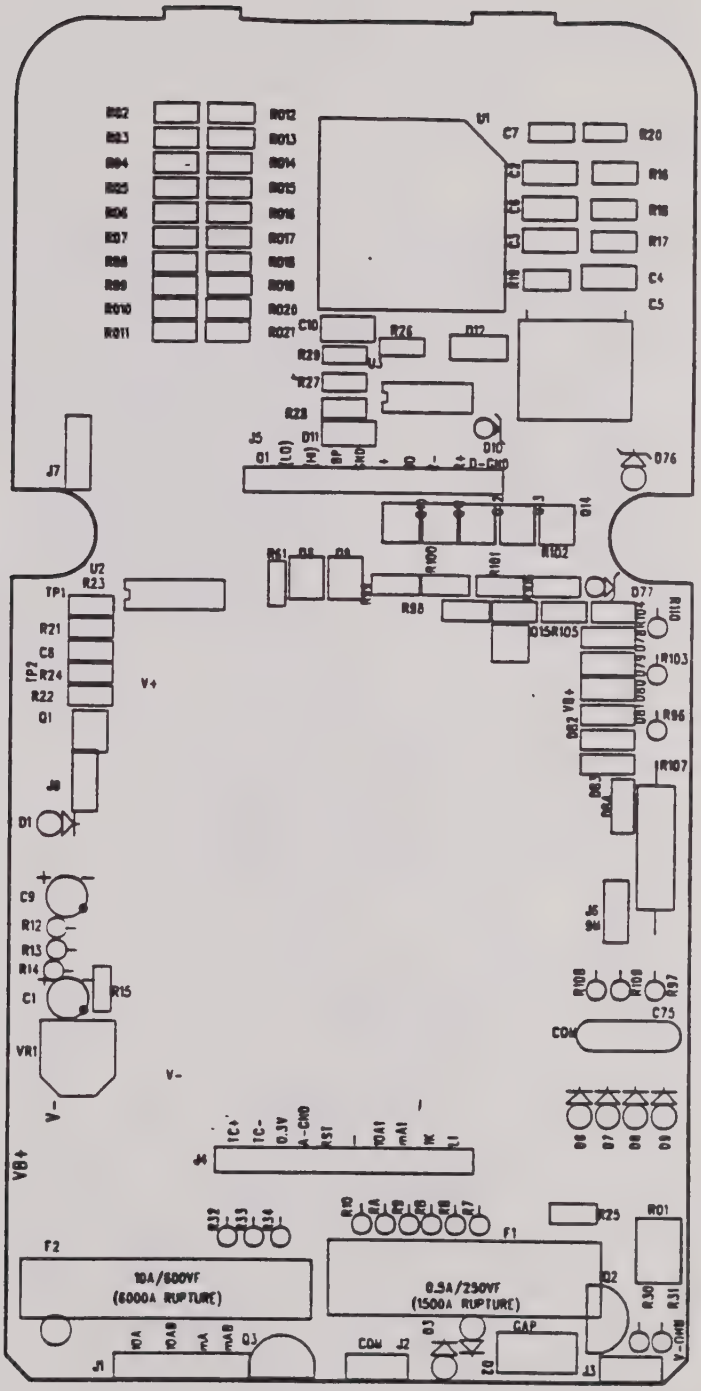
Schematic
Components Location
PCB Layout
Parts List



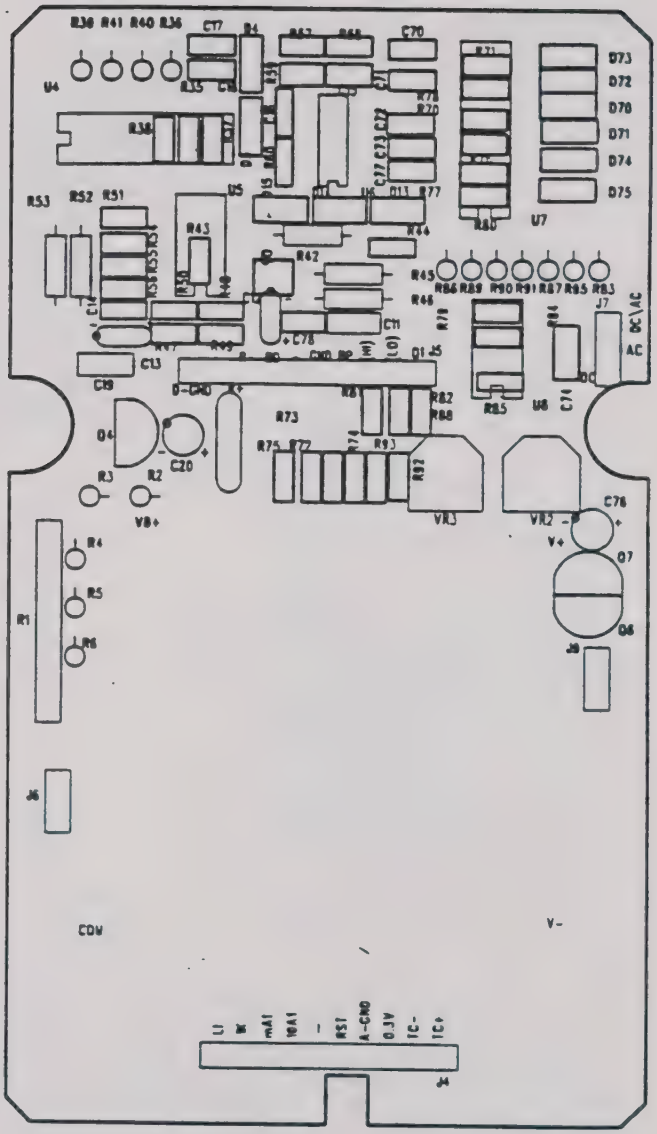
C. I. E.	MODEL	NAME	DWG	SHEET		REV	DSCN	DWN	CKD	APPVD	APPVD
	DM23XT		DM23XT-B	DATE CHX	1 OF 2 82.1.19						



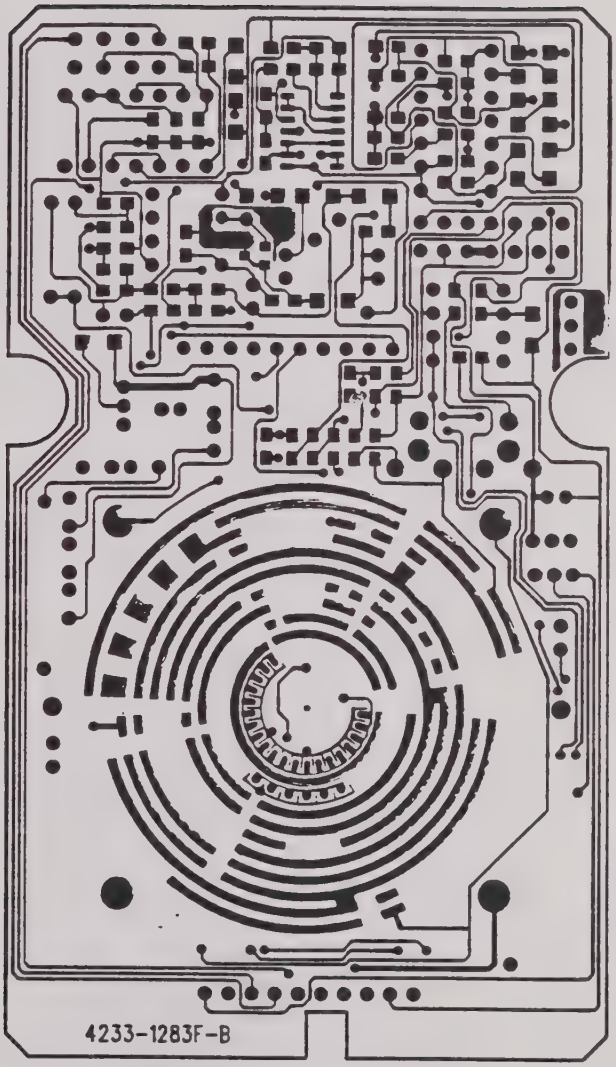
C. I. E.	MODEL	NAME	DWG	SHEET	REV	DSGN	DRN	CKD	APPVD	APPVD
	DM23XT		DM23XT-A	DATE 82.1.19						



SILKSCREEN - TOP SIDE

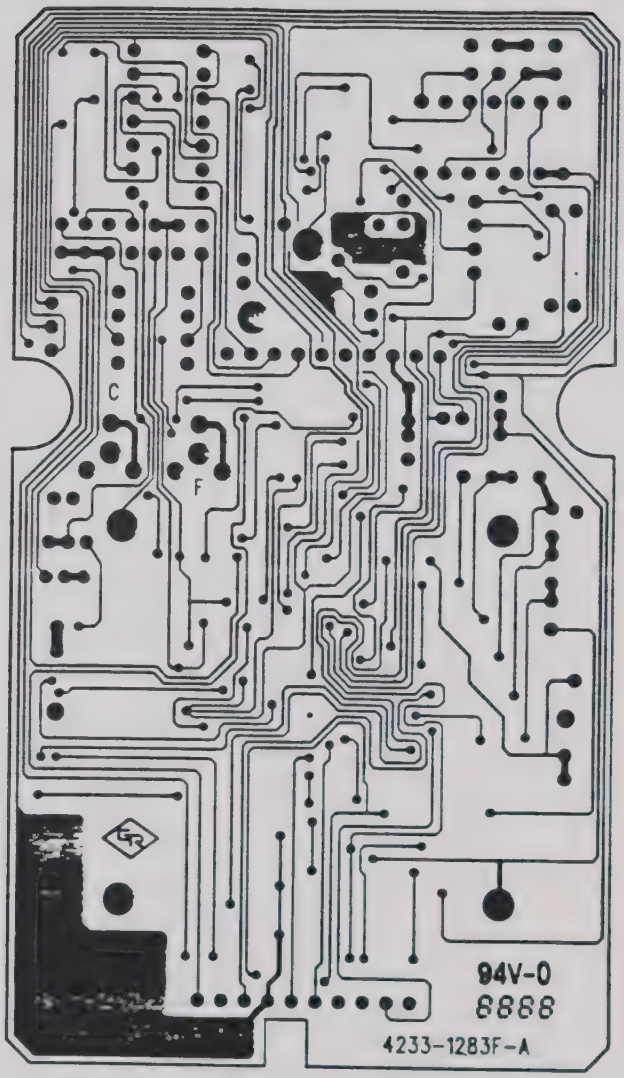


SILKSCREEN - TOP SIDE



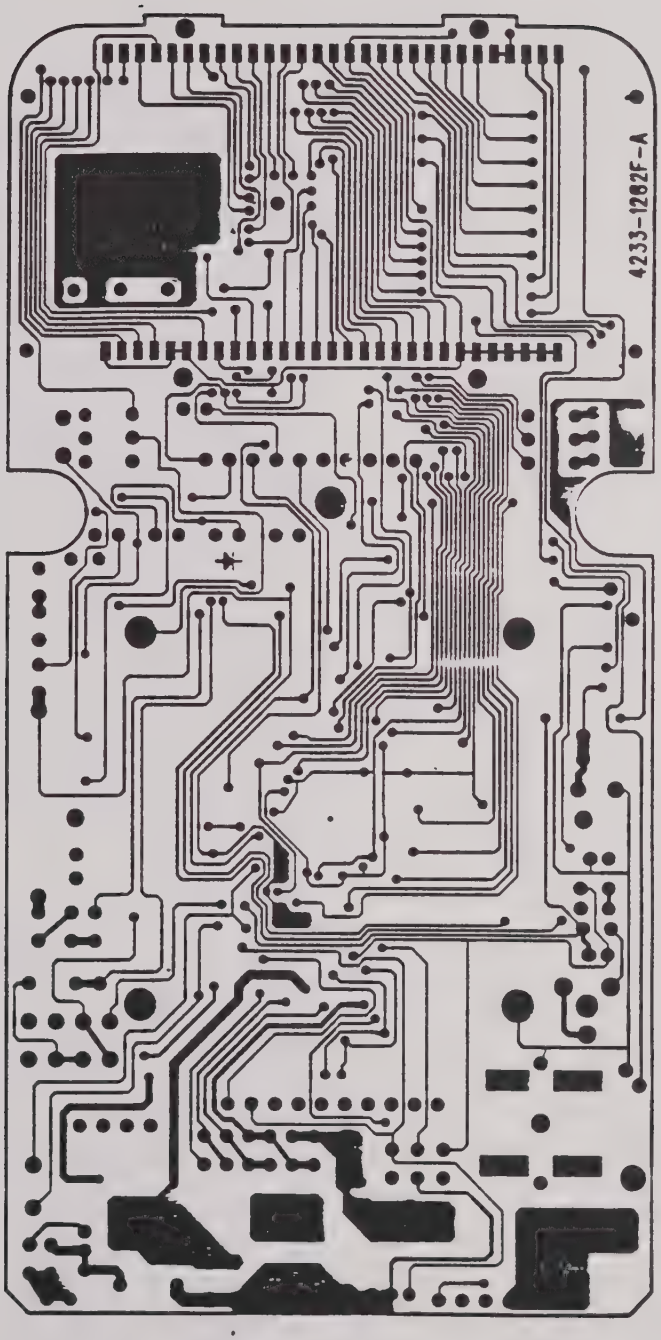
COMPONENT SIDE

DM1338T 下层



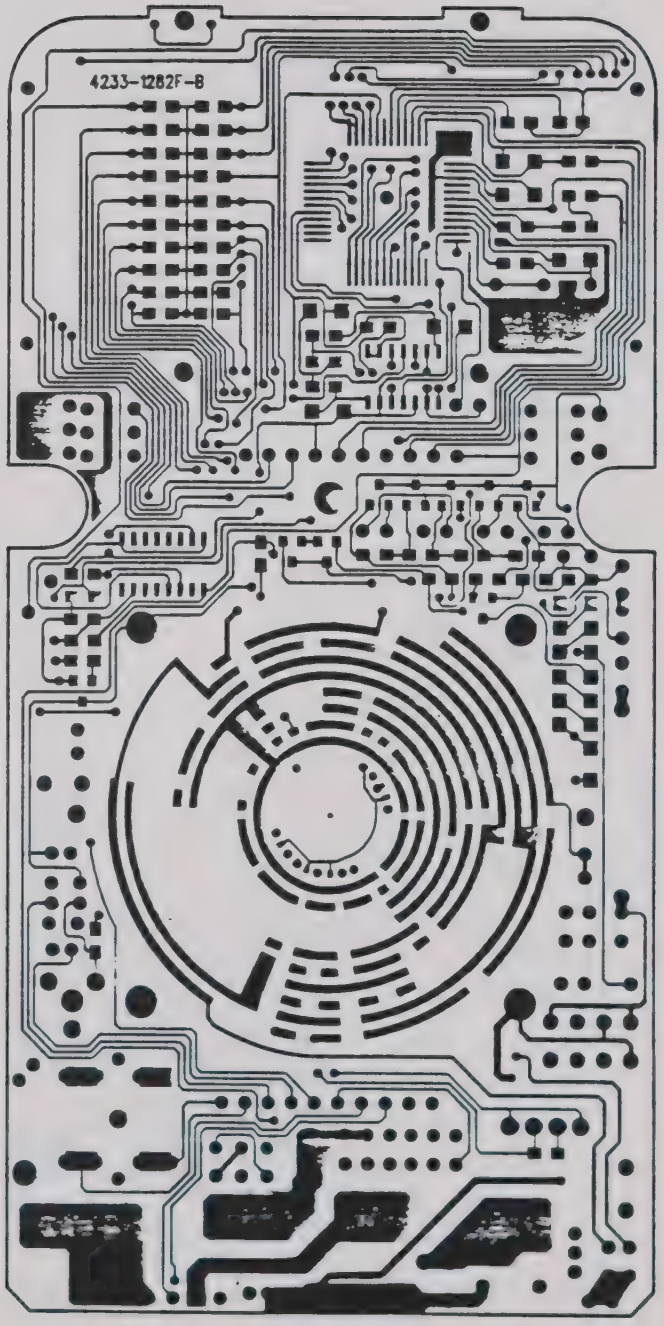
SOLDER SIDE

D4233T 下元



SOLDER SIDE

DH-330T 底片



COMPONENT SIDE

DM-38T 上片

MODEL:DM23XT

PART NO.	DESCRIPTION	OUTCLASS	UNIT	UNIT/
0020-1027	RES.CARBON.1K 5%.1/4W	1	1	
0020-1057	RES.CARBON.1M 5%.1/4W	1	2	
0020-1317	RES.CARBON.130 5%.1/4W	1	2	
0020-2267	RES.CARBON.22M 5%.1/4W	1	2	
0020-3917	RES.CARBON.390 5%.1/4W	1	1	
0050-3047	RES.CARBON.300K 5%.2W	1	1	
0100-1001	RES.MET FILM.1K 1%.1/4W	1	1	
0100-1002	RES.MET FILM.10K 1%.1/4W	1	1	
0100-1003	RES.MET FILM.100K 1%.1/4W	1	1	
0100-1008	RES.MET FILM.1 1%.1/4W	1	1	
0100-2001	RES.MET FILM.2K 1%.1/4W	1	1	
0100-2612	RES.MET FILM.26.1K 1%.1/4W	1	1	
0100-4591	RES.MET FILM.4.59K 1%.1/4W	1	1	
0100-4872	RES.MET FILM.48.7K 1%.1/4W	1	1	
0100-6342	RES.MET FILM.63.4K 1%.1/4W	1	1	
0100-9000	RES.MET FILM.900 1%,1/4W	1	1	
0102-1004	RES.MET FILM.1M.5%.0.5W	1	1	
0121-1000	RES.MET FILM,100 0.5%.1/4W	1	1	
0121-1003	RES.MET FILM,100K 0.5%.1/4W	1	1	
0121-2202	RES,MET FILM.22K 0.5%.1/4W	1	1	
0121-4322	RES MET FILM.43.2KD.1/4W	1	1	
0121-9000	RES,MET FILM,900 0.5%.1/4W	1	2	
0121-9001	RES.MET FILM.9K 0.5%,1/4W	1	2	
0121-9002	RES.MET FILM.90K 0.5%.1/4W	1	4	
0121-9003	RES.MET FILM.900K 0.5%,1/4W	1	4	
0121-9007	RES.MET FILM.90 0.5%,1/4W	1	1	
0121-9008	RES.MET FILM,9 0.5%.1/4W	1	1	
0220-1017	RES,FUSIBLE,100 5%,0.5W	1	1	
0220-4707	RES.FUSIBLE.47 5%.0.5W	1	1	
0594-1004	RES.THICK FILM.9M.0.5%	1	1	
0694-1520	PTC THERMISTOR.1.5K 500V	1	1	
0753-1008	RES.VAR.200.TOP ADJ (S)	1	2	
0753-1014	RES.VAR.250K,TOP ADJ (S)	1	1	
0910-1000	RES,SMC.100 1%.1/10W(0805)	1	1	
0910-1004	RES.SMC.1M.1%.1/10W(0805)	1	1	
0910-1912	RES.SMC.19.1K 1%.1/10W(0805)	1	1	
0910-2702	RES.SMC.27K,1%.1/10W(0805)	1	2	
0916-1007	RES.SMC.10.5%.1/10W(0805)	1	1	
0916-1037	RES.SMC.10K 5%,1/10W(0805)	1	4	
0916-1047	RES.SMC.100K 5%.1/10W(0805)	1	3	
0916-1057	RES.SMC.1M 5%.1/10W(0805)	1	29	
0916-1067	RES.SMC.10M 5%,1/10W(0805)	1	9	
0916-1147	RES.SMC.110K 5%,1/10W(0805)	1	2	
0916-1247	RES.SMC,120K 5%.1/10W(0805)	1	1	
0916-1827	RES.SMC.1.8K 5%.1/10W(0805)	1	1	
0916-2027	RES,SMC,2K 5%,1/10W(0805)	1	1	
0916-2247	RES.SMC.220K 5%.1/10W(0805)	1	1	
0916-2257	RES.SMC.2.2M 5%.1/10W(0805)	1	1	
0916-2447	RES.SMC.240K 5%.1/10W(0805)	1	1	
0916-2717	RES.SMC.270 5%,1/10W(0805)	1	1	
0916-2727	RES.SMC.2.7K.5% 1/10W(0805)	1	1	
0916-2757	RES.SMC.2.7M 5%.1/10W(0805)	1	1	
0916-3347	RES.SMC.330K 5%.1/10W(0805)	1	1	
0916-3937	RES.SMC,39K 5%.1/10W(0805)	1	1	
0916-3947	RES.SMC.390K 5%.1/10W(0805)	1	1	
0916-4727	RES.SMC.4.7K 5%.1/10W(0805)	1	1	
0916-4737	RES.SMC.47K 5%.1/10W(0805)	1	2	
0916-4747	RES.SMC.470K 5%.1/10W(0805)	1	3	
0916-5627	RES.SMC.5.6K 5%.1/10W(0805)	1	2	
0916-5647	RES.SMC.560K 5%.1/10W(0805)	1	2	
0916-7527	RES.SMC.7.5K 5%.1/10W(0805)	1	1	
0916-7547	RES.SMC,750K 5%,1/10W(0805)	1	1	

MODEL:DM23XT

PART NO.	DESCRIPTION	OUTCLASS	UNIT	UNI
0916-8227	RES.SMC.8.2K 5%.1/10W(0805)	1	1	
0916-9157	RES.SMC,9.1M 5%.1/10W(0805)	1	1	
2010-22691	CAP.ELECT.22uF 16V(S)	1	4	
2020-1059	CAP.TANT.1uF 16V	1	1	
2020-4759	CAP.TANT.4.7uF 16V	1	1	
2043-1048	CAP.MET POLYE.0.1uF 10%.50V	1	1	
2043-15471	CAP.MET POLYE.0.15uF 5%.50V(S)	1	1	
2043-22483	CAP.MET OPLYE.0.22uF 10% 63V	1	1	
2198-1001	SPARK GAP AG15PC 152FS-K44	1	1	
2301-1018	CAP.SMC,100PF 10%.63V(0805)NPO	1	2	
2301-2208	CAP.SMC,22PF 10%.63V(0805)NPO	1	1	
2301-3318	CAP.SMC.330PF 10%.63V(0805)NPO	1	2	
2301-4708	CAP.SMC.47PF 10%,63V(0805)NPO	1	2	
2401-1029	CAP.SMC.1000PF 20%.63V(0805)X7R	1	5	
2401-1039	CAP.SMC.10nF 20%.63V(0805)X7R	1	1	
2401-4739	CAP SMC.47nF.+80%-20%.25V(0805)X7R	1	1	
2412-1049	CAP SMC.0.1uF,+80%-20%.25V(1206)Y5V	1	4	
2412-2249	CAP.SMC.0.22uF,+80%-20%.25V(1206)	1	2	
3000-4001	DIODE.RECTIFIER,1A(1N4001)	1	1	
3000-4004	DIODE,RECTIFIER.1A(1N4004)	1	2	
3000-4007	DIODE.RECTIFIER.1A 1KV(1N4007)	1	4	
3018-1005	DIODE.SWITCHING SMC.BAS32L(SOD-80)	1	19	
3023-1001	DIODE.ZENER.B3/5.6V	1	1	
3023-1002	DIODE.ZENER.B1-5V (HITACHI)	1	1	
3023-1013	DIODE ZENER.75V.1W	1	1	
3200-1959	TRANSISTOR,NPN.2SC1959	1	5	
3208-1001	TRANSISTOR SMC.NPN,BSR14(SOT23)	1	1	
3208-1002	TRANSISTROR.SMC BC856B	1	2	
3208-1003	TRANSISTOR SMC .NPN BC846B	1	1	
3208-1004	TRANSISTOR SMC.NPN BC847B	1	5	
3218-1001	TRANSISTOR SMC.PNP,BSR16(SOT23)	1	1	
3800-0062	IC,OP-AMP.NJM062D	1	1	
3800-1003	IC,TLC271CP	1	1	
3810-4001	IC.C-MOS,4001	1	1	
3810-4070	IC.C-MOS.4070	1	1	
3814-4011	IC.C-MOS.4011(SO-16)	1	1	
3814-4070	IC.C-MOS.4070(SO-14)	1	1	
3814-4521	IC,C-MOS.4521(SO-16)	1	1	
3845-71061	IC.UM7106CKW(SO-48)	1	1	
4000-3042	10P FEMALE CONNECTOR	1	2	
4000-3043	2P FEMALE CONNECTOR	1	2	
4000-3044	3P FEMALE CONNECTOR	1	1	
4001-1022	2P MALE CONNECTOR STRIPS	1	2	
4001-1023	5P MALE CONNECTOR STRIPS	1	1	
4001-1030	10P CONNECT STRIP	1	2	
4001-1031	2P CONNECT STRIP	1	2	
4001-1032	3P CONNECT STRIP	1	1	
4031-1024	CONDUCTIVE RUBBER.2x3.4x63	3	2	
4042-1001	BATTERY CONNECT SNAP.80mm	2	1	
4110-5007	3-1/2 DIGIT LCD.LS-142-164A	3	1	
4132-1007	LED LAMP.RT-2527UR2	3	4	
4233-1282	PC BOARD.DM23XT(LCD)	1	1	
4233-1283	PC BOARD.DM23XT(BOTTOM)	1	1	
4233-1284	PC BOARD.DM23XT(INPUT)	1	1	
4313-1008	SILCON.RUBBER SWITCH.	4	2	
4351-1006	KEY SWITCH.PS-150A-22S	3	2	
4401-0009	BATTERY,9V(006P)	5	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	1	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	4	1	
4533-1000	CERAMIC FUSE.10A	1	1	
4610-1033	TEST LEAD	5	1	
4622-1407	ALLOY WIRE,42mm(13.5+15+13.5)	2	1	

MODEL:DM23XT

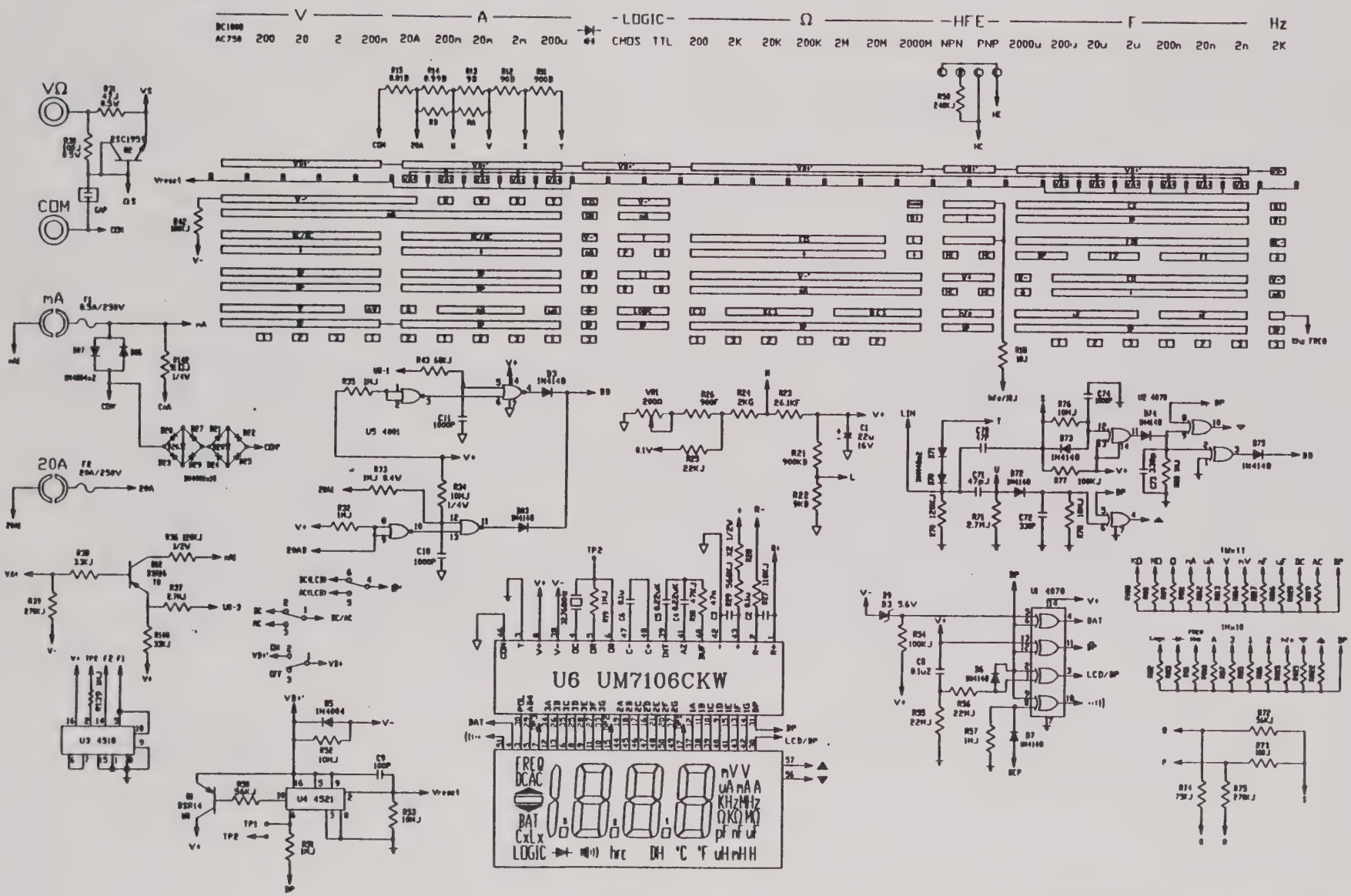
PART NO.	DESCRIPTION	OUTCLASS	UNIT	UNIT/
4700-1012	BUZZER	4	1	
5004-1016	JACK.BANANA INPUT	2	2	
5004-1017	AMPS INPUT TERMINAL	2	4	
5034-1018	HEXAGON STEEL POLE.	3	4	
5034-1019	HFE TEST PIN.	3	4	
5064-1020	INSERT SCREW.3x2x4.9mm	4	1	
5064-1027	INSERT SEREW.3x4.5x4.5	4	1	
5103-1002	FUSE HOLD (S)	1	2	
5103-1007	SPRING PLATE FOR THERMOCOUPLE JACK	2	2	
5103-1009	FUSE HOLD	1	2	
5139-1003	CONTACT PLATE.0.1mm(FOR SW TRACK)	3	12	
5162-1038	SHIELD	4	1	
5177-1013	PVC INSULATION TAPE	4	1	
5189-1011	SHOCK-PROOF SPONGE	4	1	
5196-1077	DESOLDERING.DM23XT	1	1	
5204-0060	SCREW.2x6mm	5	1	
5204-2360	SCREW.2.3x6	3	8	
5204-3050	SCREW.3*5mm	5	1	
5228-1001	STEEL BALL.1/8"	3	2	
5260-2360	SCREW.TP 2.3x6	4	3	
5260-2600	SCREW,2x5	3	5	
5260-3015	SCREW.TP 3x15	4	4	
5278-1002	SPRING	2	1	
5278-1021	BEEPER SPRING.2.0ϕ x5(STICK)	2	2	
5278-1030	SPRING	3	2	
6009-1065	TOP COVER	4	1	
6019-2052	BOTTOM COVER	4	1	
6119-1022	ROTARY BUTTON	4	1	
6129-1012	TURNTABLE.MALE.	3	1	
6129-1013	TURNTABLE.FEMALE,	3	1	
6228-1018	RUBBER.35.5x2.5x2	4	1	
6228-1019	RUBBER,36.7x4.7x2	5	2	
6228-1020	RUBBER.47.7x11x1.5	4	1	
6229-1012	METER HOLDER.	5	1	
6300-1001	SWITCH CONTROL HOLDER.	4	2	
6319-1014	TURNTABLE HOLDER.	3	1	
6320-1011		3	1	
6329-1009	HOLDER SOCKET.	5	1	
6410-1009	LCD COVER.	3	1	
6436-1012	WINDOW DECORATION PLANKING.	4	1	
6448-1011	JACK O-RING.9.6x7.6x1.0	4	4	
6448-1012	HFE O-RING.17.5x10x1.0	4	1	
6448-1013	TEMP O-RING.20.15x11x1.0	4	1	
7000-1252	INSTRUCTION MANUAL.DM23XT	5	1	
7020-1191	COLOR BOX.DM23XT	5	1	
7030-1066	SERIAL NO.,	5	1	
7030-1076	SERIAL NO.,	5	1	
7040-1029	WARRANTY CARD	5	1	
7052-1498	OVERLAY.DM23XT	5	1	
7170-1014	BLISTER PACKED	5	1	
7272-1003	PVC COVER.	5	1	
8000-1012	TEMPERATURE PROBE(TP-K01)	5	1	

TOTAL

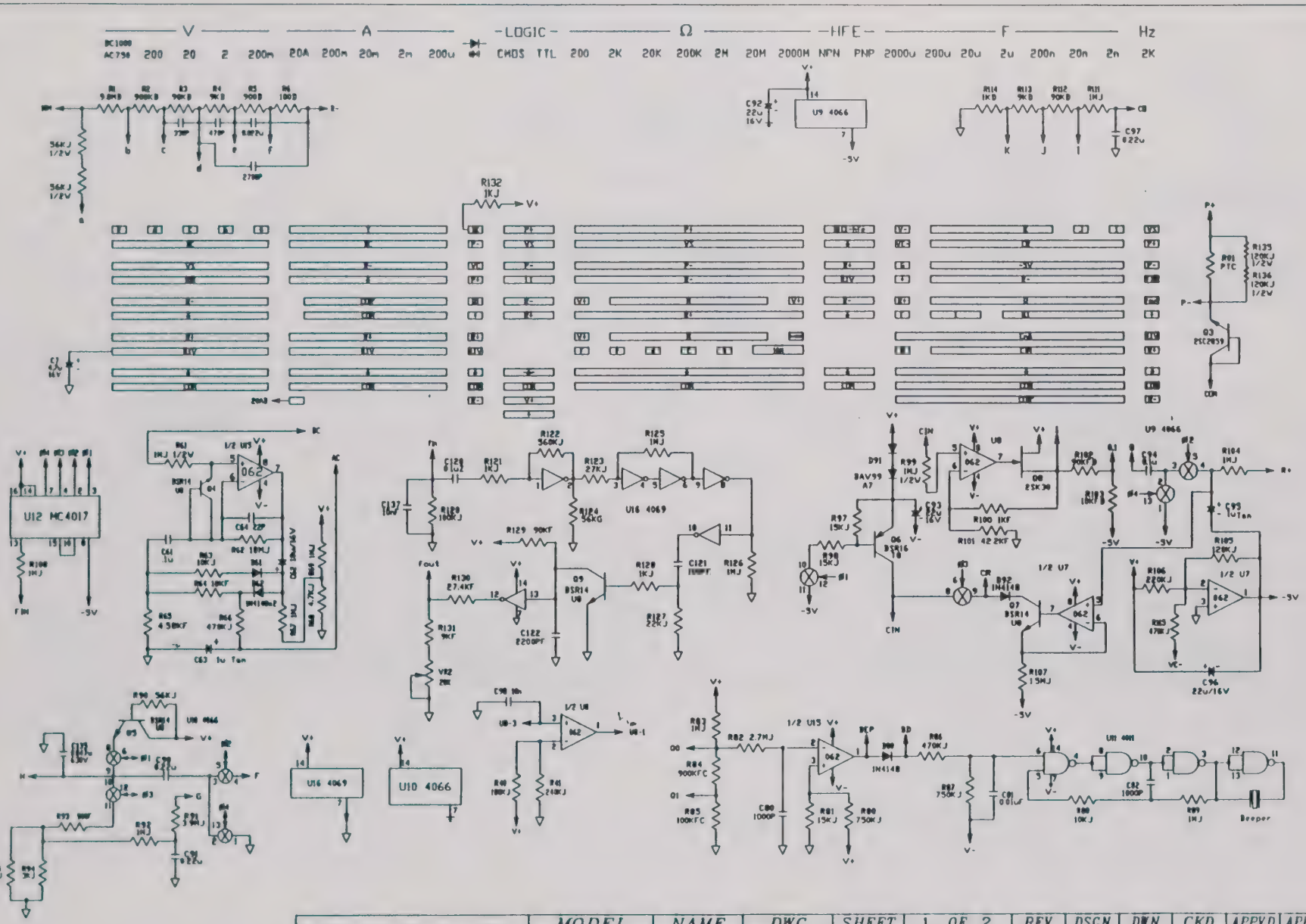
========== END ==========

Service For DM25xt

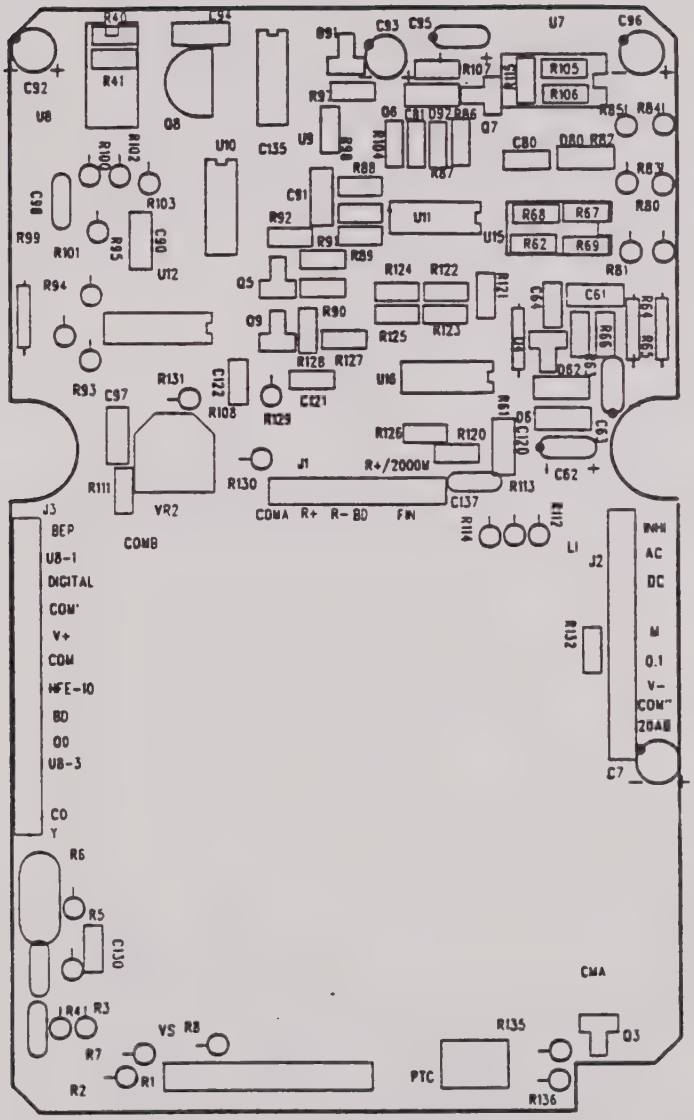
Schematic
Components Location
PCB Layout
Parts List



C. I. E.	MODEL	NAME	DWG	SHEET	1 OF 1	REV	DSCN	DWN	CKD	APPVD	APPVD
	DM25XT		DM25XT-A	DATE	82 . 5 . 3						
				CHX							

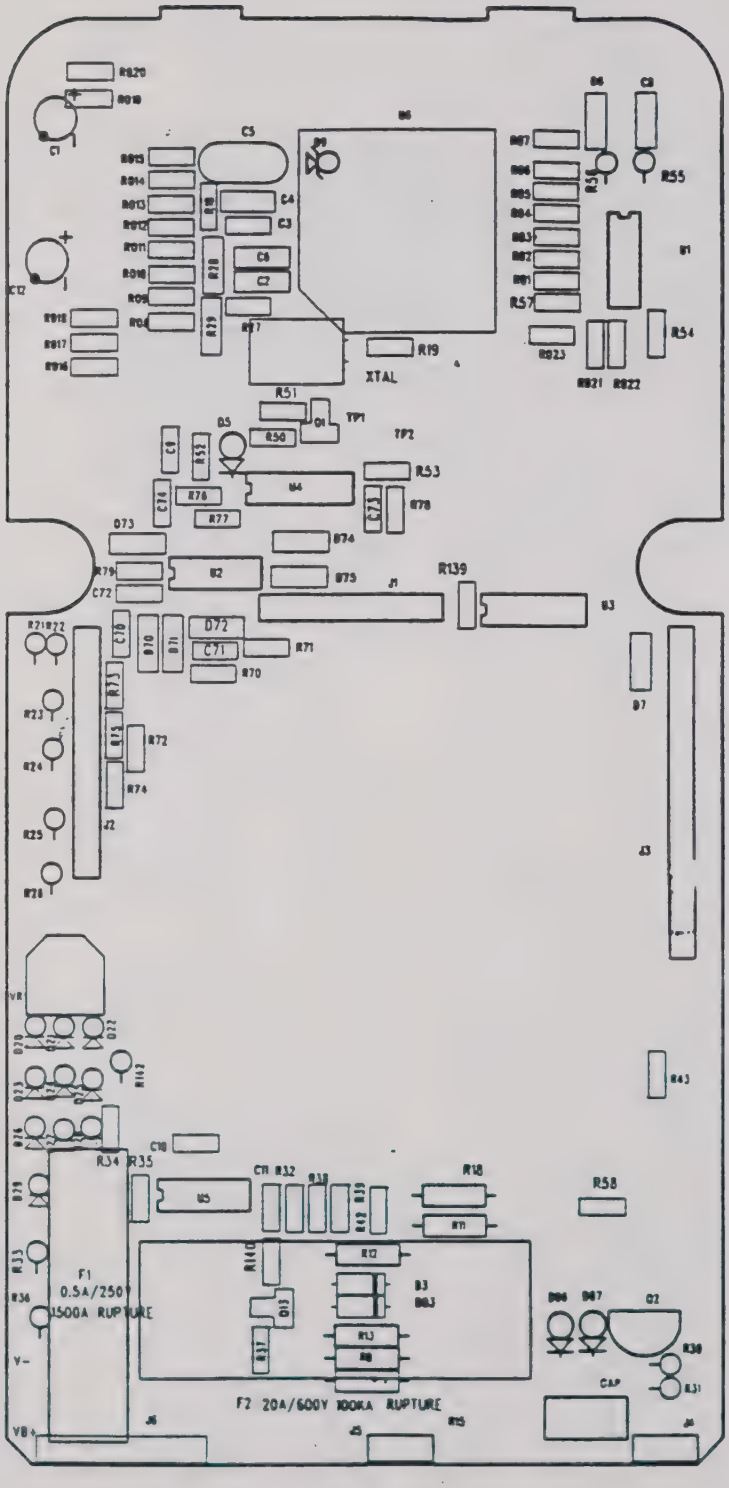


C. I. E.	MODEL	NAME	DWG	SHEET	REV	DSGN	DWN	CKD	APPVD	APPVD
	DM25XT		DM25XT-B	1 OF 2						
				DATE 82 . 3 . 16						
				CHK						

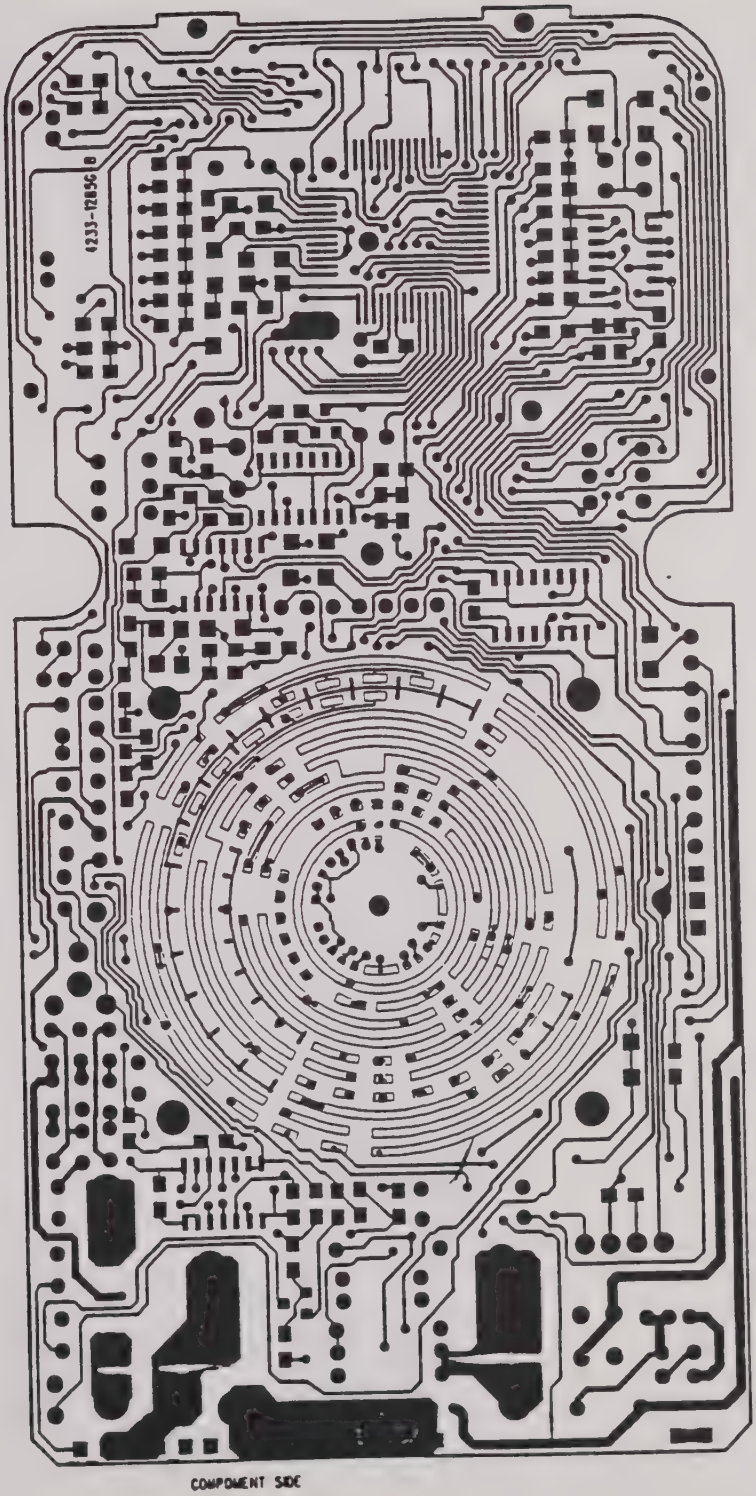


SILSCREEN TOP SIDE

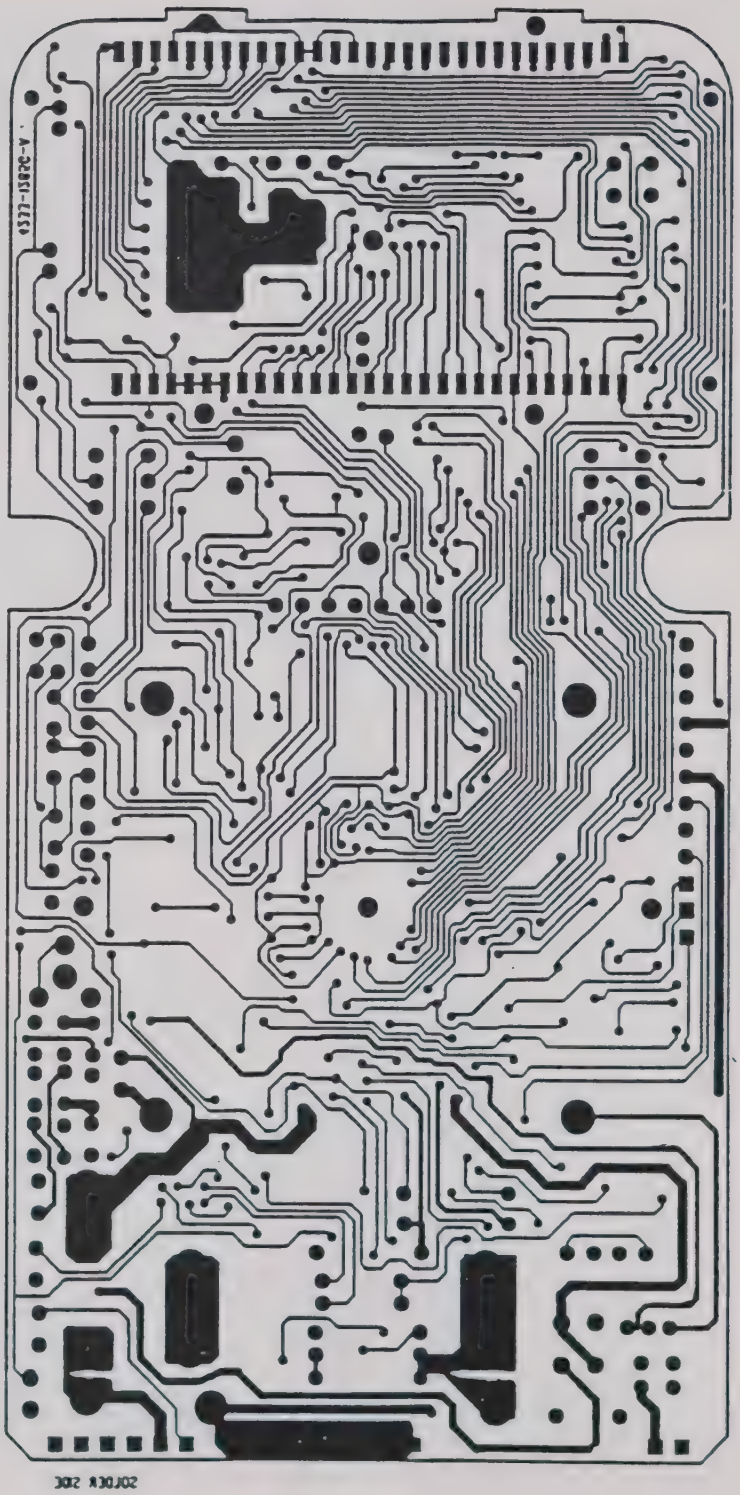
DM25XT-U.job - Tue May 18 08:54:58 1993



SILKSCREEN TOP SIDE



COMPONENT SIDE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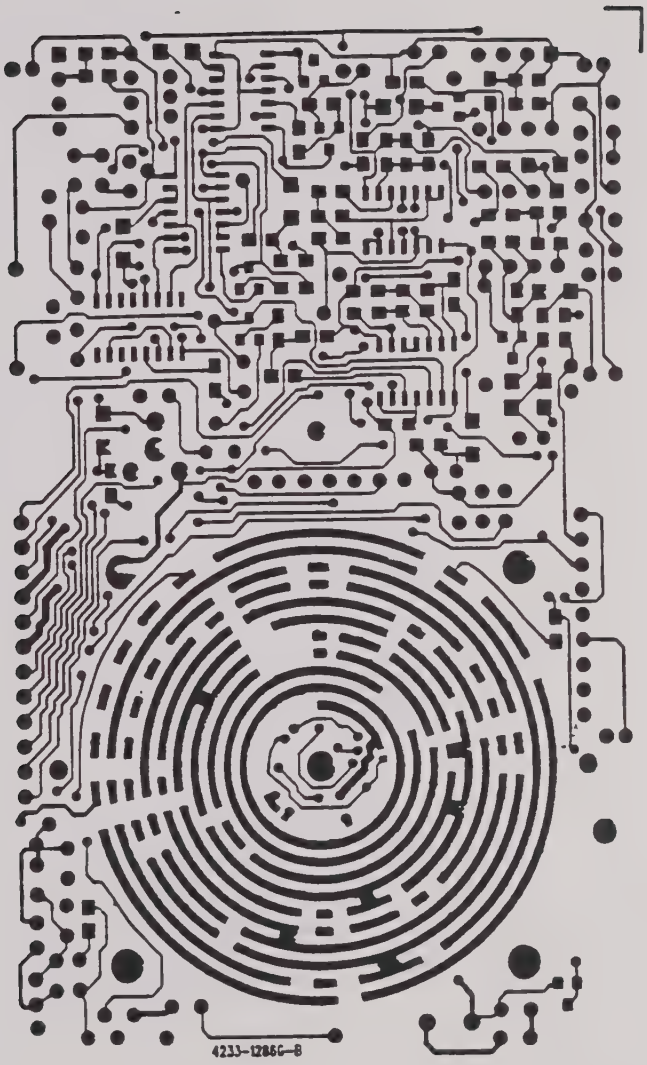
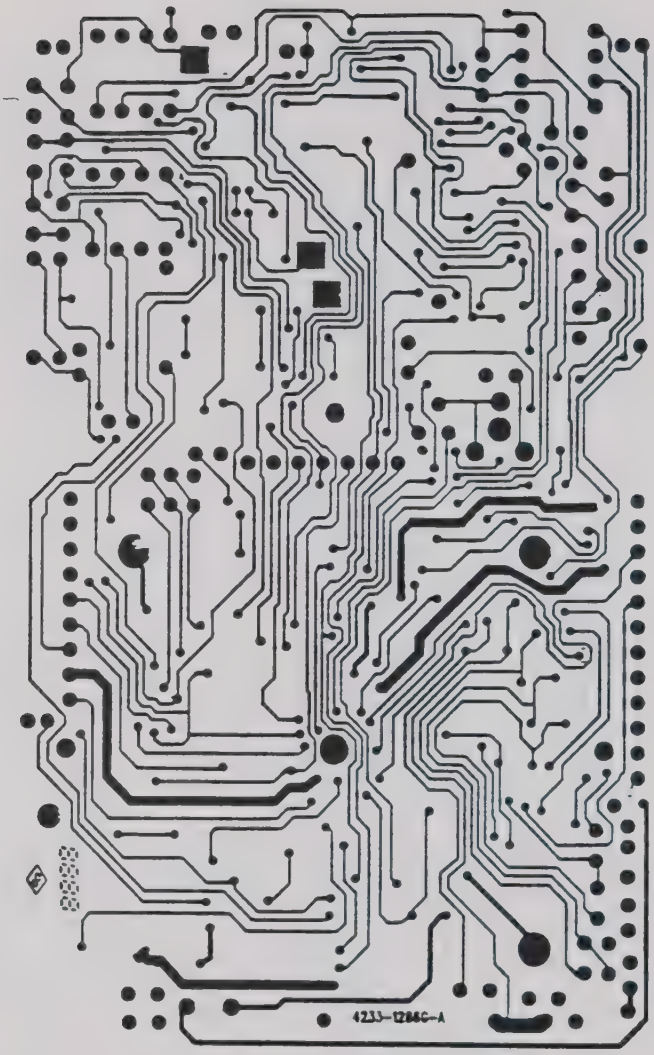


DM2587 下尺



DH-55T 下层

MODEL:DM25XT

PART NO.	DESCRIPTION	OUTCLASS	UNIT	UN
0916-6837	RES.SMC.68K,5%,1/10W(0805)	1	1	
0916-7537	RES.SMC,75K 5%.1/10W(0805)	1	1	
0916-7547	RES.SMC.750K 5%.1/10W(0805)	1	1	
0926-5647	RES.SMC.560K 5%.1/4W(1206)	1	2	
2010-22691	CAP,ELECT,22uF 16V(S)	1	5	
2010-47591	CAP.ELECT,4.7uF 16V	1	1	
2020-1059	CAP.TANT,1uF 16V	1	2	
2020-4759	CAP,TANT.4.7uF 16V	1	1	
2043-2237	CAP.MET POLYE,0.022uF 5%.50V	1	1	
2043-22483	CAP.MET OPLYE,0.22uF 10% 63V	1	1	
2046-47381	CAP,MET POLYE,0.047u 10%.400V	1	1	
2073-2227	CAP,POLYSTYRENE.2200P,5%.50V	2	1	
2080-1039	CAP.FXD CER,0.01uF 20%.16V	1	1	
2083-1027	CAP.CER.1000P 10%,50V	1	1	
2083-2727	CAP.CER.2700PF.5%.50V	1	1	
2083-5017	CAP.CER.470P 10%.50V	1	1	
2198-1001	SPARK GAP AG15PC 152FS-K44	1	1	
2301-1018	CAP.SMC.100PF 10%.63V(0805)NPO	1	2	
2301-2208	CAP.SMC.22PF 10%.63V(0805)NPO	1	1	
2301-3318	CAP,SMC,330PF 10%,63V(0805)NPO	1	3	
2301-4708	CAP,SMC,47PF 10%,63V(0805)NPO	1	2	
2401-1029	CAP,SMC,1000PF 20%,63V(0805)X7R	1	6	
2401-1039	CAP,SMC,10nF 20%,63V(0805)X7R	1	1	
2401-4739	CAP SMC,47nF,+80%-20%,25V(0805)X7R	1	1	
2412-1049	CAP SMC.0.1uF,+80%-20%,25V(1206)Y5V	1	5	
2412-2249	CAP,SMC,0.22uF,+80%-20%,25V(1206)	1	3	
3000-4001	DIODE,RECTIFIER.1A(1N4001)	1	11	
3000-4004	DIODE,RECTIFIER,1A(1N4004)	1	2	
3013-4148	DIODE,SWITCHING,1N4148	1	2	
3018-1003	DIODE,SWITCHING SMC,BAV99(SOT99)	1	1	
3018-1005	DIODE,SWITCHING SMC,BAS32L(SOD-80)	1	11	
3023-1001	DIODE,ZENER,B3/5.6V	1	1	
3200-1959	TRANSISTOR,NPN,2SC1959	1	1	
3208-1001	TRANSISTOR SMC,NPN,BSR14(SOT23)	1	4	
3208-1006	TRANSISTROR SMC.2SC2859	1	1	
3218-1001	TRANSISTOR SMC,PNP.BSR16(SOT23)	1	3	
3400-1003	FET.N-CHANNEL.2SK30A	1	1	
3800-0062	IC.OP-AMP.NJM062D	1	3	
3814-4001	IC.C-MOS 4001(SO-16)	1	1	
3814-4011	IC.C-MOS.4011(SO-16)	1	1	
3814-4017	IC,C-MOS.HEF4017B(SO-16)	1	1	
3814-4066	IC.C-MOS.MC14066BCP(SO-14)	1	2	
3814-4069	IC,C-MOS,4069(SO-14)	1	1	
3814-4070	IC.C-MOS.4070(SO-14)	1	1	
3814-40701	IC,MC4070BD	1	1	
3814-4518	IC,C-MOS,HEF4518(SO-16)	1	1	
3814-4521	IC,C-MOS.4521(SO-16)	1	1	
3845-71061	IC.UM7106CKW(SO-48)	1	1	
4000-3045	12P FEMALE CONNECTOR	1	1	
4000-3046	7P FEMALE CONNECTOR	1	1	
4000-3047	9P FEMALE CONNECTOR	1	1	
4001-1022	2P MALE CONNECTOR STRIPS	1	2	
4001-1033	12P CONNECT STRIP	1	1	
4001-1034	7P CONNECT STRIP	1	1	
4001-1035	9P CONNECT STRIP	1	1	
4001-1036	6P MALE CONNECTOR STRIPS	1	1	
4031-1024	CONDUCTIVE RUBBER.2x3.4x63	3	2	
4042-1005	BATTERY CONNECT SNAP,63mm(T-TYPE)	2	1	
4110-5007	3-1/2 DIGIT LCD,LS-142-164A	3	1	
4233-1285	PC BOARD,DM25XT(LCD)	1	1	
4233-1286	PC BOARD,DM25XT(BOTTOM)	1	1	
4233-1287	PC BOARD.DM25XT(INPUT)	1	1	

MODEL:DM25XT

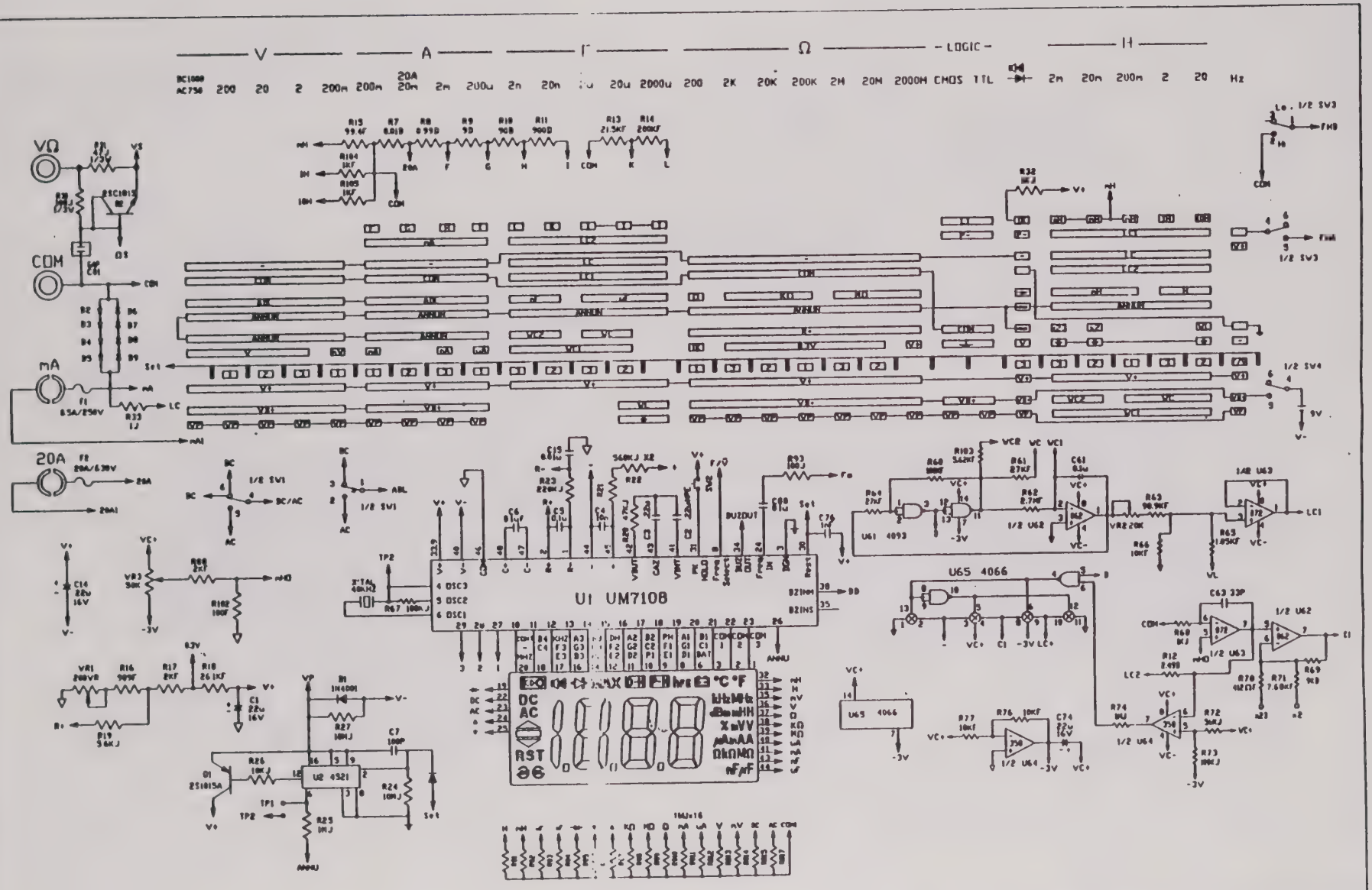
PART NO.	DESCRIPTION	OUTCLASS	UNIT
0010-1057	RES.CARBON,1M 5%,1/8W	1	1
0010-1537	RES.CARBON.15K 5%.1/8W	1	1
0010-2027	RES.CARBON,2K 5%.1/8W	1	1
0010-2237	RES.CARBON.22K 5%.1/8W	1	1
0010-2267	RES.CARBON.22M 5%,1/8W	1	2
0010-2757	RES.CARBON,2.7M 5%,1/8W	1	1
0010-7547	RES,CARBON,750KJ,1/8W	1	1
0020-1007	RES:CARBON.10 5%.1/4W	1	1
0020-5107	RES.CARBON.51 5%,1/4W	1	1
0100-1002	RES.MET FILM,10K 1%.1/4W	1	1
0100-1008	RES.MET FILM,1 1%.1/4W	1	1
0100-4222	RES.MET FILM,42.2K 1%,1/4W	1	1
0100-4591	RES.MET FILM.4.59K 1%.1/4W	1	1
0102-1004	RES.MET FILM.1M,5%.0.5W	1	3
0102-1203	RES.MET FILM.120K 5%.0:5W(SFR25H)	1	3
0102-5602	RES,MET FILM,56K,5%,0.5W	1	2
0121-9000	RES.MET FILM,900 0.5%,1/4W	1	1
0121-9007	RES.MET FILM.90 0.5%,1/4W	1	1
0121-9008	RES.MET FILM.9 0.5%,1/4W	1	1
0160-2612	RES.MET FILM,26.1K 1%,1/8W	1	1
0160-2742	RES.MET FILM,27.4K 1%.1/8W	1	1
0160-9312	RES.MET FILM 93.1KF 1% 1/8W	1	1
0171-1000	RES.MET FILM,100 0.5%.1/8W(MRS-16T)	1	2
0171-1001	RES.MET FILM.1K 0.5%.1/8W(MRS-16T)	1	2
0171-1002	RES,MET FILM,10K 0.5%,1/8W	1	1
0171-1003	RES,MET FILM,100K 0.5%.1/8W	1	1
0171-5621	RES.MET FILM.5.62KD.1/8W(MRS-16T)	1	1
0171-9000	RES.MET FILM.900 0.5%,1/8W(MRS16T)	1	3
0171-9001	RES,MET FILM,9K 0.5%,1/8W(MRS-16T)	1	3
0171-9002	RES,MET FILM,90K 0.5%.1/8W(MRS-16T)	1	3
0171-9003	RES.MET FILM.900K0.5%.1/8W(SFR-16T)	1	3
0220-1017	RES,FUSIBLE,100 5%.0.5W	1	1
0220-4707	RES,FUSIBLE,47 5%,0.5W	1	1
0594-1004	RES,THICK FILM,9M,0.5%	1	1
0694-1520	PTC THERMISTOR.1.5K 500V	1	1
0753-1008	RES,VAR,200,TOP ADJ (S)	1	1
0753-1016	RES.VAR,820K,TOP ADJ(S)	1	1
0916-1027	RES.SMC.1K 5%.1/10W(0805)	1	4
0916-1037	RES.SMC,10K 5%.1/10W(0805)	1	2
0916-1047	RES.SMC.100K 5%.1/10W(0805)	1	4
0916-1057	RES,SMC,1M 5%.1/10W(0805)	1	35
0916-1067	RES.SMC,10M 5%,1/10W(0805)	1	5
0916-1147	RES.SMC,110K 5%.1/10W(0805)	1	1
0916-1247	RES,SMC,120K 5%.1/10W(0805)	1	2
0916-1457	RES.SMC.1.4MJ 5%.1/10W(0805)	1	1
0916-1537	RES.SMC,15K 5%.1/10W(0805)	1	2
0916-1847	RES.SMC,180K 5%.1/10W(0805)	1	1
0916-2047	RES.SMC.200K 5%.1/10W(0805)	1	1
0916-2237	RES.SMC.22K 5%.1/10W(0805)	1	1
0916-2247	RES.SMC.220K 5%.1/10W(0805)	1	1
0916-2447	RES.SMC,240K 5%.1/10W(0805)	1	2
0916-2737	RES.SMC.27K 5%.1/10W(0805)	1	2
0916-2747	RES.SMC.270K 5%.1/10W(0805)	1	2
0916-2757	RES.SMC.2.7M 5%.1/10W(0805)	1	2
0916-3327	RES.SMC,3.3K 5%.1/10W(0805)	1	1
0916-3337	RES,SMC,33K 5%.1/10W(0805)	1	1
0916-3957	RES.SMC.3.9M 5%.1/10W(0805)	1	1
0916-4727	RES,SMC.4.7K 5%.1/10W(0805)	1	2
0916-4737	RES.SMC,47K 5%.1/10W(0805)	1	1
0916-4747	RES.SMC,470K 5%,1/10W(0805)	1	2
0916-5637	RES.SMC.56K 5%,1/10W(0805)	1	4
0916-5647	RES.SMC.560K 5%.1/10W(0805)	1	1

PART NO.	DESCRIPTION	OUTCLASS	UNIT	UN
4313-1008	SILCON.RUBBER SWITCH,	4	2	
4351-1006	KEY SWITCH,PS-150A-22S	3	2	
4401-0009	BATTERY,9V(006P)	5	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	1	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	4	1	
4533-2001	CERAMIC FUSE,20A/600V(38x10mm)	2	1	
4610-1031	TEST LEAD	5	1	
4610-1033	TEST LEAD	5	1	
4621-1003	ALLOY WIRE	2	1	
4700-1012	BUZZER	4	1	
4800-3272	CRYSTAL 32.768KHz	1	1	
5004-1016	JACK.BANANA INPUT	2	2	
5004-1017	AMPS INPUT TERMINAL	2	4	
5034-1018	HEXAGON STEEL POLE,	3	4	
5034-1019	HFE TEST PIN.	3	4	
5064-1020	INSERT SCREW,3x2x4.9mm	4	1	
5064-1027	INSERT SEREW.3x4.5x4.5	4	1	
5103-1002	FUSE HOLD (S)	1	2	
5103-1005	FUSE HOLDER	1	2	
5139-1003	CONTACT PLATE,0.1mm(FOR SW TRACK)	3	12	
5162-1038	SHIELD	4	1	
5177-1013	PVC INSULATION TAPE	4	1	
5189-1011	SHOCK-PROOF SPONGE	4	1	
5196-1077	DESOLDERING.DM23XT	1	1	
5204-0060	SCREW.2x6mm	5	1	
5204-2360	SCREW.2.3x6	3	8	
5204-3050	SCREW.3*5mm	5	1	
5228-1001	STEEL BALL,1/8	3	2	
5260-2360	SCREW,TP 2.3x6	4	3	
5260-2600	SCREW.2x5	3	4	
5260-3015	SCREW,TP 3x15	4	4	
5278-1002	SPRING	2	1	
5278-1021	BEEPER SPRING.2.0ϕ x5(STICK)	2	2	
5278-1030	SPRING	3	2	
6009-1066	TOP COVER.DM25XT	4	1	
6019-2052	BOTTOM COVER	4	1	
6119-1022	ROTARY BUTTON	4	1	
6129-1012	TURNTABLE,MALE,	3	1	
6129-1013	TURNTABLE.FEMALE.	3	1	
6228-1018	RUBBER,35.5x2.5x2	4	1	
6228-1019	RUBBER,36.7x4.7x2	5	2	
6228-1020	RUBBER.47.7x11x1.5	4	1	
6229-1012	METER HOLDER,	5	1	
6300-1001	SWITCH CONTROL HOLDER,	4	2	
6319-1014	TURNTABLE HOLDER.	3	1	
6329-1009	HOLDER SOCKET,	5	1	
6410-1009	LCD COVER,	3	1	
6436-1012	WINDOW DECORATION PLANKING.	4	1	
6448-1011	JACK O-RING.9.6x7.6x1.0	4	4	
6448-1012	HFE O-RING,17.5x10x1.0	4	1	
7000-1252	INSTRUCTION MANUAL.DM23XT	5	1	
7020-1195	COLOR BOX.DM25XT	5	1	
7030-1066	SERIAL NO.,	5	1	
7030-1076	SERIAL NO.,	5	1	
7040-1029	WARRANTY CARD	5	1	
7052-1499	OVERLAY.DM25XT	5	1	
7170-1014	BLISTER PACKED	5	1	
				TOTA

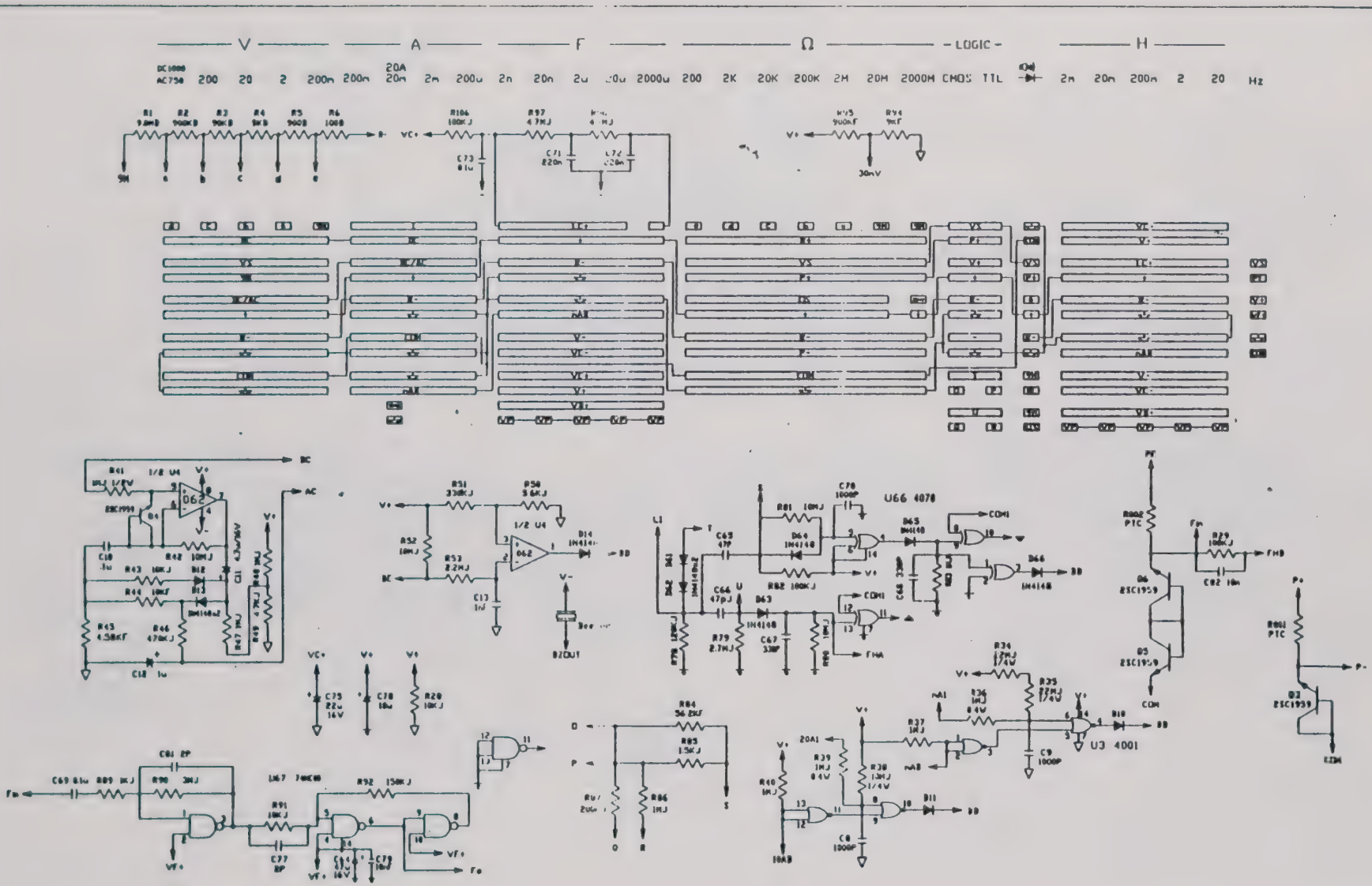
========== END ==========

Service For DM27xt

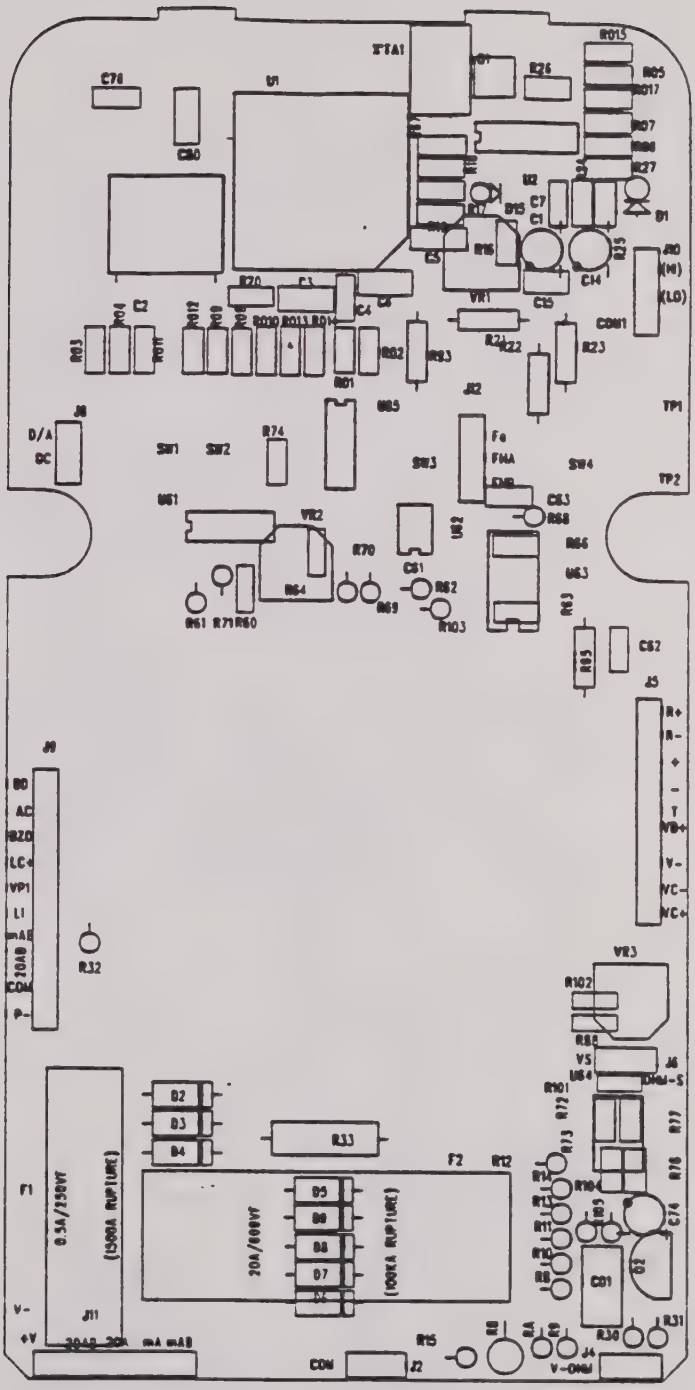
Schematic
Components Location
PCB Layout
Parts List



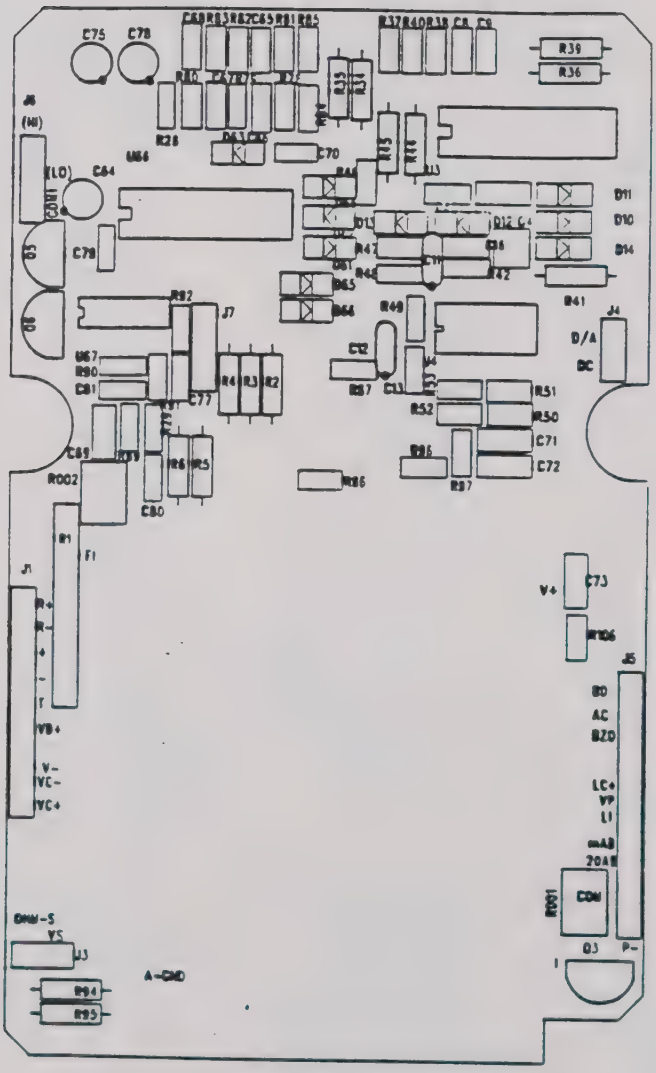
C. I. E.	MODEL	NAME	DWG	SHEET	1 OF 2	REV	DSGN	DWN	CKD	APPVD	APPVD
	DM27XT		DM27XT-A	DATE	82 . 2 . 23						
				CHK							



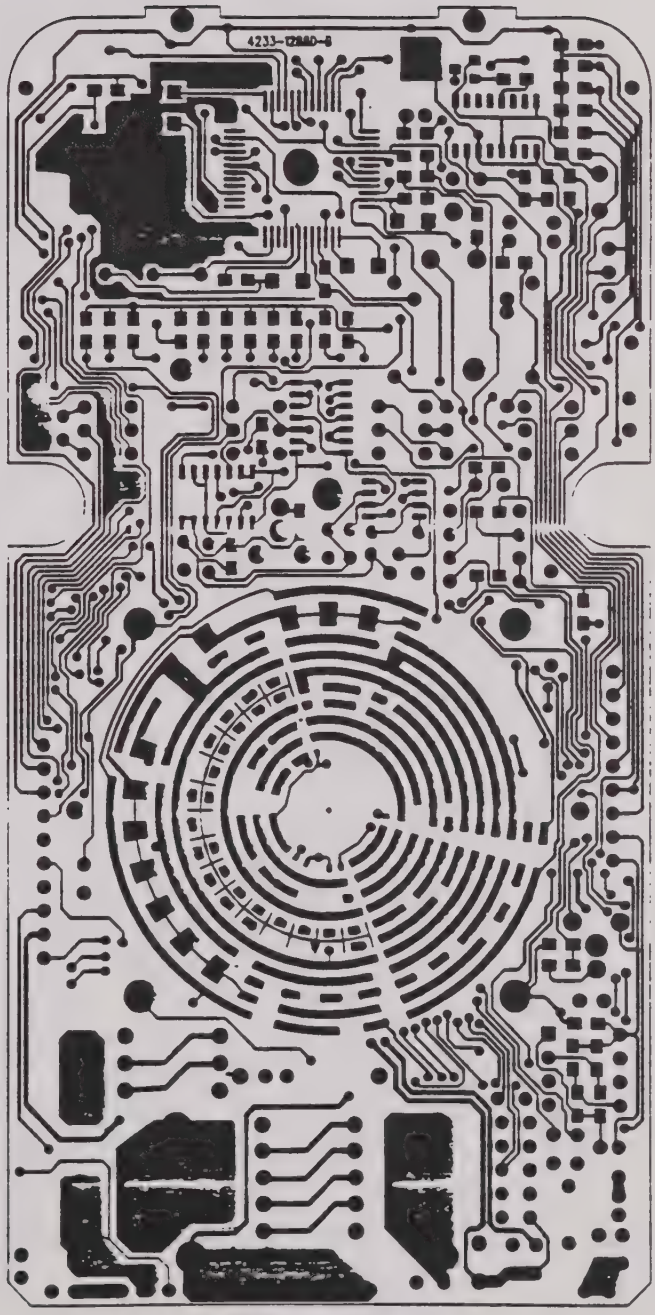
	MODEL	NAME	DWG	SHEET	1 OF 2	REV	DSGN	DWN	CKD	APPVD	APPVD
				DATE							



SILKSCREEN SIDE

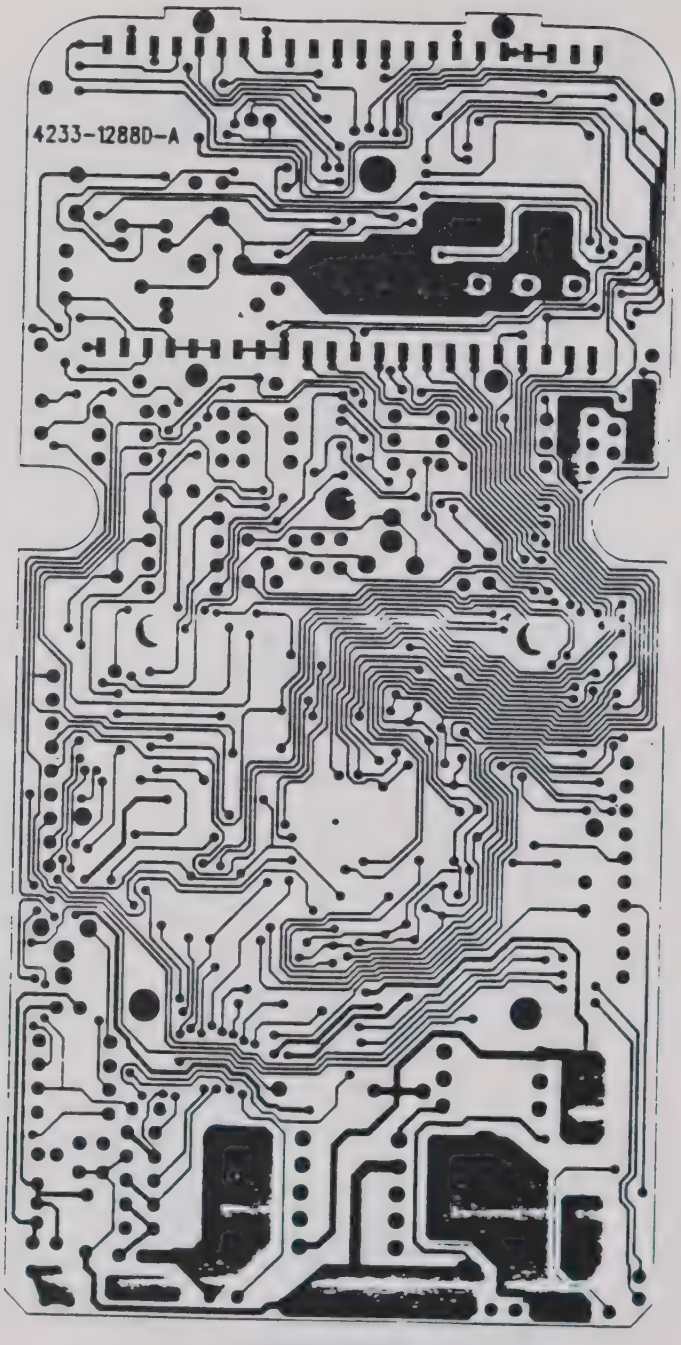


SILKSCREEN-TOP SIDE



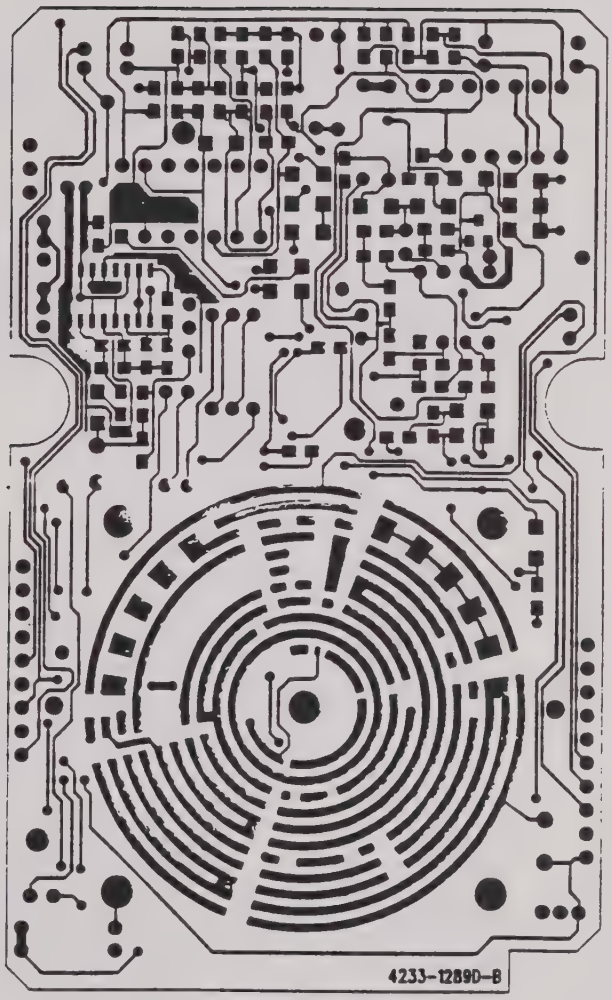
COMPONENT SIDE

DM707 北



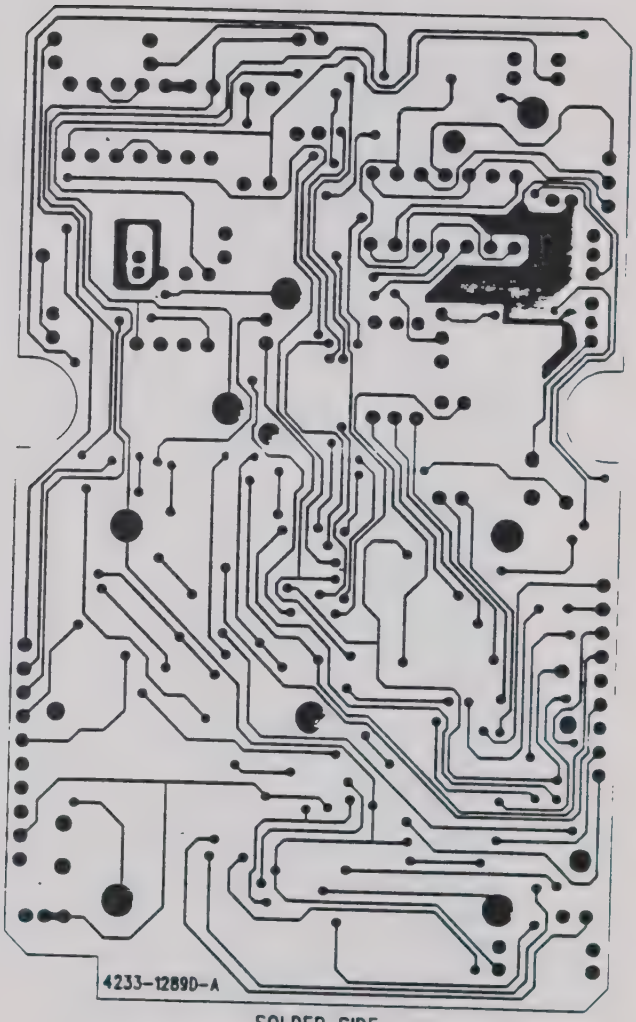
SOLDER SIDE

DH-787 보호



COMPONENT SIDE

DM-77T 下足



SOLDER SIDE

DM558 下 丁片

MODEL:DM27XT

PART NO.	DESCRIPTION	OUTCLASS	UNIT	UNIT
0020-1017	RES.CARBON.100 5%,1/4W	1	1	
0020-1027	RES.CARBON,1K 5%.1/4W	1	2	
0020-2247	RES.CARBON.220K 5%,1/4W	1	1	
0020-2267	RES.CARBON.22M 5%.1/4W	1	2	
0100-1001	RES.MET FILM.1K 1%.1/4W	1	2	
0100-1002	RES,MET FILM.10K 1%,1/4W	1	1	
0100-1051	RES.MET FILM.1.05K 1%,1/4W	1	1	
0100-2003	RES.MET FILM,200K 1%,1/4W	1	1	
0100-2152	RES.MET FILM,21.5K 1%.1/4W	1	1	
0100-2702	RES.MET FILM.27K 1%,1/4W	1	1	
0100-2704	RES.MET FILM.2.7M 1%.1/4W	1	1	
0100-4591	RES,MET FILM.4.59K 1%,1/4W	1	1	
0100-5621	RES.MET FILM,5.62K 1%.1/4W	1	1	
0100-7681	RES.MET FILM,7.68K 1%.1/4W	1	1	
0100-9001	RES.MET FILM.9K 1%.1/4W.	1	1	
0102-1004	RES,MET FILM.1M.5%.0.5W	1	3	
0102-5603	RES.MET FILM.560K 5%.0.5W(SFR25H)	1	2	
0121-1000	RES,MET FILM,100 0.5%,1/4W	1	1	
0121-2498	RES.MET FILM.2.49 0.5%.1/4W	1	1	
0121-4120	RES.MET FILM.412 0.5%,1/4W	1	1	
0121-9000	RES.MET FILM,900 0.5%.1/4W	1	2	
0121-9001	RES,MET FILM,9K 0.5%.1/4W	1	2	
0121-9002	RES,MET FILM,90K 0.5%,1/4W	1	1	
0121-9003	RES.MET FILM,900K 0.5%.1/4W	1	2	
0121-9007	RES.MET FILM,90 0.5%,1/4W	1	1	
0121-9008	RES,MET FILM,9 0.5%,1/4W	1	1	
0121-9947	RES.MET FILM.99.4 0.5%.1/4W	1	1	
0220-1017	RES.FUSIBLE,100 5%,0.5W	1	1	
0220-4707	RES,FUSIBLE.47 5%,0.5W	1	1	
0440-1001	RES.WIRE WOUND,0.99 0.5%,2W	1	2	
0594-1004	RES.THICK FILM,9M,0.5%	1	1	
0694-1520	PTC THERMISTOR.1.5K 500V	1	2	
0753-1008	RES.VAR,200.TOP ADJ (S)	1	1	
0753-1016	RES,VAR,B20K,TOP ADJ(S)	1	1	
0753-1018	RES.VAR.B50K,TOP ADJ(S)	1	1	
0910-1000	RES.SMC.100 1%.1/10W(0805)	1	1	
0910-1002	RES.SMC.10K.1%.1/10W(0805)	1	3	
0910-1003	RES.SMC.100K.1%.1/10W(0805)	1	1	
0910-2001	RES,SMC.2K,1%,1/10W(0805)	1	2	
0910-2612	RES.SMC.26.1K 1%.1/10W(0805)	1	1	
0910-2702	RES.SMC.27K.1%.1/10W(0805)	1	1	
0910-5622	RES.SMC.56.2K.1%.1/10W(0805)	1	1	
0910-9090	RES.SMC.909 1%,1/10W(0805)	1	1	
0910-9092	RES.SMC.90.9K 1%.1/10W(0805)	1	1	
0916-1027	RES.SMC,1K 5%.1/10W(0805)	1	1	
0916-1037	RES.SMC,10K 5%,1/10W(0805)	1	4	
0916-1047	RES,SMC,100K 5%.1/10W(0805)	1	5	
0916-1057	RES.SMC.1M 5%.1/10W(0805)	1	24	
0916-1067	RES.SMC.10M 5%.1/10W(0805)	1	7	
0916-1247	RES.SMC.120K 5%.1/10W(0805)	1	1	
0916-1527	RES.SMC.1.5K 5%,1/10W(0805)	1	1	
0916-1547	RES.SMC.150K 5%.1/10W(0805)	1	1	
0916-2047	RES.SMC.200K 5%.1/10W(0805)	1	1	
0916-2257	RES.SMC.2.2M 5%,1/10W(0805)	1	1	
0916-2757	RES.SMC,2.7M 5%.1/10W(0805)	1	1	
0916-3057	RES,SMC,3M 5%,1/10W(0805)	1	1	
0916-3347	RES,SMC.330K 5%,1/10W(0805)	1	1	
0916-4727	RES.SMC,4.7K 5%,1/10W(0805)	1	1	
0916-4737	RES.SMC,47K 5%.1/10W(0805)	1	1	
0916-4747	RES.SMC,470K 5%.1/10W(0805)	1	1	
0916-4757	RES.SMC,4.7M 5%.1/10W(0805)	1	2	
0916-5627	RES.SMC.5.6K 5%.1/10W(0805)	1	2	

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PART NO.	DESCRIPTION	OUTCLASS	UNIT	U
0916-5637	RES.SMC.56K 5%.1/10W(0805)	1	1	
2010-10691	CAP,ELECT.10uF 16V(S)	1	1	
2010-22691	CAP.ELECT.22uF 16V(S)	1	4	
2010-4769	CAP ELECT.47uF.20%.10V(S)	1	1	
2020-1059	CAP.TANT.1uF 16V	1	1	
2020-4759	CAP.TANT.4.7uF 16V	1	1	
2043-1048	CAP,MET POLYE,0.1uF 10%.50V	1	1	
2043-22483	CAP.MET DPLYE.0.22uF 10% 63V	1	1	
2198-1001	SPARK GAP AG15PC 152FS-K44	1	1	
2301-1018	CAP,SMC,100PF 10%.63V(0805)NPO	1	1	
2301-2098	CAP.SMC.2PF 10%.63V(0805)NPO	1	2	
2301-3308	CAP.SMC.33PF 10%.63V(0805)NPO	1	1	
2301-3318	CAP.SMC.330PF 10%,63V(0805)NPO	1	2	
2301-4708	CAP.SMC.47PF 10%.63V(0805)NPO	1	2	
2401-1029	CAP.SMC,1000PF 20%.63V(0805)X7R	1	5	
2401-1039	CAP.SMC,10nF 20%.63V(0805)X7R	1	4	
2412-1049	CAP SMC.0.1uF,+80%-20%.25V(1206)Y5V	1	6	
2412-2249	CAP.SMC,0.22uF.+80%-20%.25V(1206)	1	3	
3000-1002	DIODE,RECTIFIER,PR1504	1	8	
3000-4001	DIODE,RECTIFIER,1A(1N4001)	1	1	
3013-4148	DIODE,SWITCHING,1N4148	1	1	
3018-1005	DIODE.SWITCHING SMC,BAS32L(SOD-80)	1	11	
3200-1959	TRANSISTOR,NPN,2SC1959	1	4	
3208-1001	TRANSISTOR SMC.NPN.BSR14(SOT23)	1	1	
3218-1001	TRANSISTOR SMC.PNP.BSR16(SOT23)	1	1	
3800-0062	IC.OP-AMP.NJM062D	1	1	
3800-0072	IC.OP-AMP.TL072CP	1	1	
3800-0358	IC.OP-AMP.LM358N	1	1	
3804-1004	IC.OP-AMP,062(SO-8)	1	1	
3810-4001	IC.C-MOS.4001	1	1	
3810-4070	IC.C-MOS,4070	1	1	
3814-1004	IC.C-MOS.74HC00(SO-14)	1	1	
3814-4066	IC,C-MOS.MC14066BCP(SO-14)	1	1	
3814-4093	IC,C-MOS.4093(SO-14)	1	1	
3814-4521	IC.C-MOS.4521(SO-16)	1	1	
3845-7108	IC.UM7108F(QFP48PIN)	1	1	
4000-3042	10P FEMALE CONNECTOR	1	1	
4000-3043	2P FEMALE CONNECTOR	1	2	
4000-3044	3P FEMALE CONNECTOR	1	2	
4000-3047	9P FEMALE CONNECTOR	1	1	
4001-1022	2P MALE CONNECTOR STRIPS	1	2	
4001-1030	10P CONNECT STRIP	1	1	
4001-1031	2P CONNECT STRIP	1	2	
4001-1032	3P CONNECT STRIP	1	2	
4001-1035	9P CONNECT STRIP	1	1	
4001-1036	6P MALE CONNECTOR STRIPS	1	1	
4031-1024	CONDUCTIVE RUBBER.2x3.4x63	3	2	
4042-1005	BATTERY CONNECT SNAP.63mm(T-TYPE)	2	1	
4110-5022	LCD.ABT-6072-32S	3	1	
4233-1287	PC BOARD.DM25XT(INPUT)	2	1	
4233-1288	PC BOARD.DM27XT(LCD)	1	1	
4233-1289	PC BOARD.DM27XT(BOTTOM)	1	1	
4312-1008	SILCON.RUBBER SWITCH.	4	4	
4351-1001	KEY-SWITH(PS-150)	3	1	
4351-1006	KEY SWITCH.PS-150A-22S	3	3	
4401-0009	BATTERY,9V(006P)	5	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	1	1	
4532-0500	CERAMIC FUSE.0.5A 250V(5x20mm)	4	1	
4533-2001	CERAMIC FUSE.20A/600V(38x10mm)	2	1	
4610-1031	TEST LEAD	5	1	
4610-1033	TEST LEAD	5	1	
4621-1003	ALLOY WIRE	2	1	

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PART NO.	DESCRIPTION	OUTCLASS	UNIT	UNIT
4700-1012	BUZZER	3	1	
4800-4000	CRYSTAL.40KHZ	1	1	
5004-1016	JACK.BANANA INPUT	2	2	
5004-1017	AMPS INPUT TERMINAL	2	4	
5034-1018	HEXAGON STEEL POLE,	3	4	
5064-1020	INSERT SCREW,3x2x4.9mm	4	1	
5064-1027	INSERT SEREW.3x4,5x4.5	4	1	
5103-1002	FUSE HOLD (S)	1	2	
5103-1005	FUSE HOLDER	1	2	
5139-1003	CONTACT PLATE,0.1mm(FOR SW TRACK)	3	12	
5162-1038	SHIELD	4	1	
5177-1013	PVC INSULATION TAPE	4	1	
5189-1011	SHOCK-PROOF SPONGE	4	1	
5196-1077	DESOLDERING,DM23XT	1	1	
5204-0060	SCREW.2x6mm	5	1	
5204-2360	SCREW.2.3x6	3	8	
5204-3050	SCREW.3*5mm	5	1	
5228-1001	STEEL BALL.1/8"	3	2	
5260-1080	SCREW,TP 2.3*8mm	4	3	
5260-2600	SCREW.2x5	3	4	
5260-3015	SCREW.TP 3x15	4	4	
5278-1002	SPRING	2	1	
5278-1021	BEEPER SPRING.2.0ϕ x5(STICK)	2	2	
5278-1030	SPRING	3	2	
6009-1067	TOP COVER.DM27XT	4	1	
6019-2052	BOTTOM COVER	4	1	
6119-1022	ROTARY BUTTON	4	1	
6129-1012	TURNTABLE,MALE.	3	1	
6129-1013	TURNTABLE.FEMALE.	3	1	
6228-1018	RUBBER.35.5x2.5x2	4	1	
6228-1019	RUBBER,36.7x4.7x2	4	2	
6228-1020	RUBBER.47.7x11x1.5	4	1	
6229-1012	METER HOLDER.	5	1	
6300-1001	SWITCH CONTROL HOLDER.	3	4	
6319-1014	TURNTABLE HOLDER.	3	1	
6329-1009	HOLDER SOCKET.	5	1	
6410-1009	LCD COVER.	3	1	
6436-1012	WINDOW DECORATION PLANKING.	4	1	
6448-1011	JACK O-RING.9.6x7.6x1.0	4	4	
7000-1252	INSTRUCTION MANUAL.DM23XT	5	1	
7020-1196	COLOR BOX.DM27XT	5	1	
7030-1066	SERIAL NO..	5	1	
7030-1076	SERIAL NO..	5	1	
7040-1029	WARRANTY CARD	5	1	
7052-1500	OVERLAY.DM27XT	5	1	
7170-1014	BLISTER PACKED	5	1	
				TOTAL

========== END ==========

Theory of Operation

7106F A/D Converter
Display Layout

UMC

UMC

UM7106/07A/07B

3 1/2-Digit A/D Converter

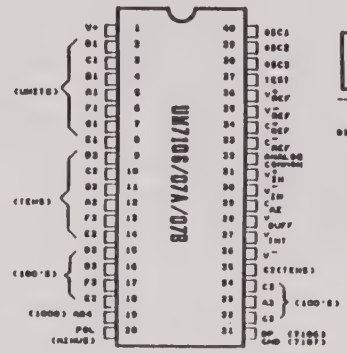
Features

- Guaranteed zero reading with zero input
- True polarity indication for precision null detection
- Low noise
- Convenient 9V battery operation
- Low power operation-10mW
- High impedance CMOS differential inputs $10^{12}\Omega$
- True differential input and reference
- Direct display drive for UM7106 LCD, UM7107A/B LED
- No additional active components required
- Low linearity error: guaranteed less than 1 count
- Internal reference with low temperature drift
- Applications: digital panel meters, digital multimeters, thermometers, capacitance meters, PH meters, photometers etc.

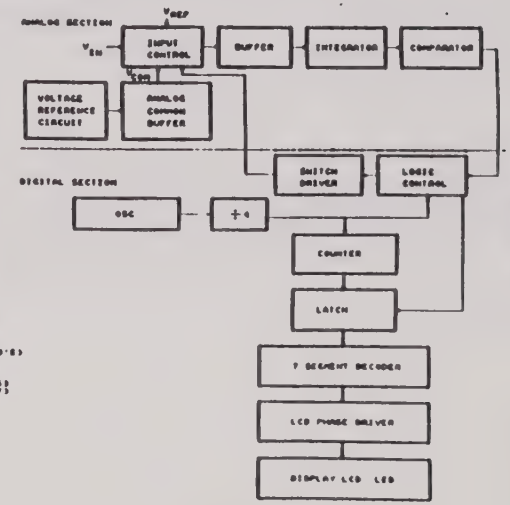
General Description

The UM7106 and UM7107A/B are high performance, low power 3 ½-digit A/D converters. All the necessary active devices are contained in a single CMOS IC, including seven-segment decoder,display driver, Voltage reference and clock. UM7106 is designed to interface with a liquid crystal display (LCD) and UM7107A/B will directly drive an instrument-sized light emitting diode (LED) display. The UM7106 and UM7107A/B bring the combination of high accuracy, versatility and economy. High accuracy, like auto-zero to less than 100μV for 2.00V full-scale measurement, or 10μV for 200.0 mV full-scale measurement, input bias current of 10pA max , and rollover of less than one count. The versatility of true differential input and Voltage reference is useful in all systems,such as strain gauges or bridge-type tranducers.

Pin Configuration



Block Diagram



Absolute Maximum Ratings*

Supply Voltage (V+ to V-) 15V
Analog Input Voltage (either input) . . . . . V+ to V-
Reference Input Voltage (either input) . . . . V+ to V-
Clock Input . . . . . Test to V+
Power Dissipation 800mW
Operating Temperature . . . . . 0°C to +70°C
Storage Temperature . . . . . -55°C to +150°C
Lead Temperature (Soldering, 60 sec) . . . . . 300°C

*Comments

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Electrical Characteristics

Unless otherwise noted, specifications apply to UM7106 at V_{supply} (V^+ to V^-) = 9.0V, and UM7107A/B at V_{supply} (V^+ to V^-) = 10.0V

T_A = 25°C, f clock = 48kHz, UM7106 is tested in the CKT of Fig 7, UM7107A/B is tested in the CKT of Fig 8.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Zero Input Reading	V_{IN} = 0.0V Full Scale = 200.0mV	-000.0	±000.0	+000.0	Digital Reading
Ratiometric Reading	$V_{IN} = V_{ref}$ V_{ref} = 100.0mV	999	999/1000	1000	Digital Reading
Linearity (Max. Deviation From Best Straight Line Fit)	Full Scale 200.0 mV or 2.000V	-1	±0.2	+1	Counts
Noise	V_{IN} = 0V Full Scale 200.0mV	-	15	-	μV
Leakage Current Input	V_{IN} = 0V	-	1	10	PA
Zero Reading Drift	V_{IN} = 0 0° < T_A < 70°C	-	0.2	1	μV/°C
Scale Factor Temp Coeff	V_{IN} = 199.0mV 0° < T_A < 70°C	-	1	5	ppm/°C
Analog Common Voltage (With Respect to Pos Supply)	25KΩ Between Common and Pos Supply	2.7	3.0	3.3	V
Temp Coeff of Analog Common	25KΩ Between Common and Pos Supply	-	20	50	ppm/°C

DC Electrical Characteristics (Continued)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Supply Current (Doesn't Include LED and Com. Current)	V_{IN} = 0	-	0.8	1.8	mA
UM7106 Only, Pk-Pk Segment Drive Voltage		4	5	6	V
UM7106 Only, Pk-Pk Back Plane Drive Voltage		4	5	6	V
UM7107A/B Only, Segment Sinking Current (Except Pin 19)	V_{supply} = 5.0V Segment Voltage = 3V	5	8.0	-	mA
UM7107A/B Only, Segment Sinking Current (Pin 19 Only)	V_{supply} = 5.0V Segment Voltage = 3V	10	16	-	mA
Rollover Error	$V_{IN}^- = V_{IN}^+$ = 200.0mV	-1	±0.2	+1	Counts
Common-mode Rejection Ratio	V_{CM} = ±1V_{IN}, V_{IN} = 0V Full-scale = 200.0mV	-	50	200	μV/V

Pin Description

Pin No.	Designation	Description
1	V+	Positive supply voltage.
2	D1	Activates the D section of the units display.
3	C1	Activates the C section of the units display.
4	B1	Activates the B section of the units display.
5	A1	Activates the A section of the units display.
6	F1	Activates the F section of the units display.
7	G1	Activates the G section of the units display.

Pin Description (Continued)

Pin No.	Designation	Description
8	E1	Activates the E section of the units display.
9	D2	Activates the D section of the units display.
10	C2	Activates the C section of the tens display.
11	B2	Activates the B section of the tens display.
12	A2	Activates the A section of the tens display.
13	F2	Activates the F section of the tens display.
14	E2	Activates the E section of the tens display.
15	D3	Activates the D section of the hundreds display.
16	B3	Activates the B section of the hundreds display.
17	F3	Activates the F section of the hundreds display.
18	E3	Activates the E section of the hundreds display.
19	AB4	Activates both halves of the 1 in the thousands display.
20	POL	Activates the negative polarity display.
21	BP GND	LCD Backplane drive output (UM7106). Digital Ground (UM7107A), but keep floating for UM7107B
22	G3	Activates the G section of the hundreds display.
23	A3	Activates the A section of the hundreds display.
24	C3	Activates the C section of the hundreds display.
25	G2	Activates the G section of the tens display.
26	V^-	Negative power supply voltage.
27	V_{INT}	Integrator output. Connection point for integration capacitor.
28	V_{BUFF}	Integration resistor connection. Use 47KΩ for a 200mV full-scale range and 470KΩ for 2V full-scale range.

Pin Description (Continued)

Pin No.	Designation	Description
29	C_{AZ}	The size of the auto-zero capacitor influences the system noise. Use a 0.47 capacitor for a 200mV full-scale, and a 0.047μF capacitor for a 2 volt full-sca
30	V_{IN}^-	The analog low input is connected to this pin.
31	V_{IN}^+	The analog high input signal is connected to this pin.
32	Analog Common	This pin is primarily used to set the analog common-mode voltage for batte operation or in systems where the input signal is referenced to the power suppl
33	C_{REF}^-	See pin 34.
34	C_{REF}^+	A 0.1μF capacitor is used in most applications. If a large common-mode voltag exists (for example the V_{IN}^- pin is not at analog common), and a 200 mV scale used, a 1.0μF capacitor is recommended which will hold the rollover error to 0 count.
35	V_{REF}^-	See pin 36.
36	V_{REF}^+	This analog input is required to generate a full-scale output (1,999 counts).Plac 100 mV between pins 35 and 36 for 199.9 mV full-scale. Place 1.00 volt betwee pins 35 and 36 for 2 volt full-scale.
37	TEST	Lamp test. When pulled high (to V^+), all segments will be turned on and th display should read-1888. It may also be used as a negative supply for external generated decimal points.
38	OSC3	See pin 40.
39	OSC2	See pin 40.
40	OSC1	Pins 40, 39, & 38 make up the oscillator section. For a 48KHz clock (3 reading per Second), connect pin 40 to the junction of a 100KΩ resistor and a 100 p capacitor. The 100KΩ resistor is tied to pin 39 and the 100pF capacitor is tie to pin 38.

Function Description

An input signal to be measured is applied to the integrating capacitance for a fixed time as determined by a clock counter. The accumulated charge will be proportional to the input signal, for a fixed clock rate and constant current. The resulting integral is returned to zero by integrating a reference signal of polarity opposite that of the input signal. The length of time required for the integrator to return to zero, as measured with the clock counter to display at output,is proportional to the average magnitude of the input signal over the integration period.

a. Analog Section

Fig. 1 shows the block diagram of the Analog Section for UM7106 and UM7107A/B. Each measurement cycle is divided into three parts. They are (1) Auto-zero [A-Z] (2) Signal integrated [INT] (3) Deintegrated [DE].

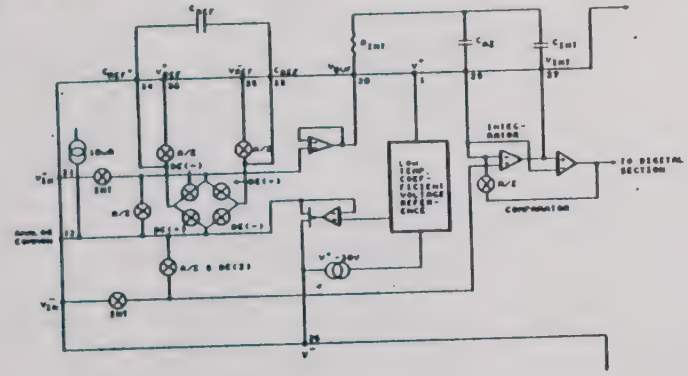


Figure 1. UM7106/07A/07B Analog Section

1. Auto Zero Phase

During Auto-Zero, three things happen:

(1) input high and low are disconnected from PIN and shorted to analog COMMON.
(2) the reference capacitor is charged to the reference voltage.
(3) a feedback loop is closed around the system to charge the auto-zero capacitor C_{AZ} to compensate for offset voltages in the buffer amplifier, integrator and comparator.

2. Signal Integrate Phase

During signal integrate, the auto zero loop is opened ,the internal short is removed, and the internal inputs high and low are connected to the external pins. The converter then integrates the differential voltage between input high and input low for a fixed time (1000 counts). At the end of this phase, the polarity of the integrated signal is determined.

3. De-Integrate Phase

The final phase is de-integrate, or reference integrate. Input low is internally connected to Analog COMMON and input high is connected across the previously charged reference capacitor. Circuitry within the chip ensures that the capacitor will be connected with the correct polarity to cause the integrator output to return to zero. The time required to return to zero is proportional to the input signal. Specifically,the digital reading displayed is 1000 $(\frac{A_{in}}{V_{ref}})$

b. Digital Section

Fig. 2, Fig. 3 and Fig. 4 show the digital section for the UM7106 and UM7107A/B, respectively. In the UM7106, the internal digital ground is generated from a 6.2 volt Zener diode and a large p-channel follower. This supply is made stiff to absorb the relatively large capacitive current when the back plane (BP) is switched. The BP frequency is the clock frequency divided by 800. The segments are driven at the same frequency and amplitude and are in phase with BP when OFF, but out of phase when ON. In all cases negligible DC voltage exists across the segments.

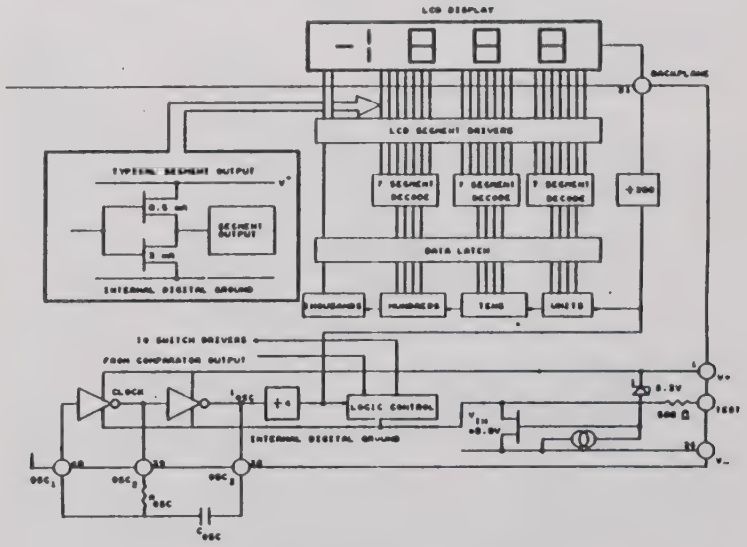


Figure 2. UM7106 Digital Section

Fig. 3 is the Digital Section of the UM7107A. It is identical except the regulated supply and back plane drive have been eliminated and the segment drive has been increased from 2 mA to 8 mA. Pin 19 must sink current twice the drive capability.

Fig. 4 is the Digital Section of the UM7107B. It is similar to UM7107A except UM7107B provides an internal digital ground (same as UM7106), so user does not need to provide external digital ground for UM7107B and keep pin 21 floating. It is suggested that user place a 120 Ω resistor between V and common anode LED to limit the current into UM7107B to gain better performance and save energy.

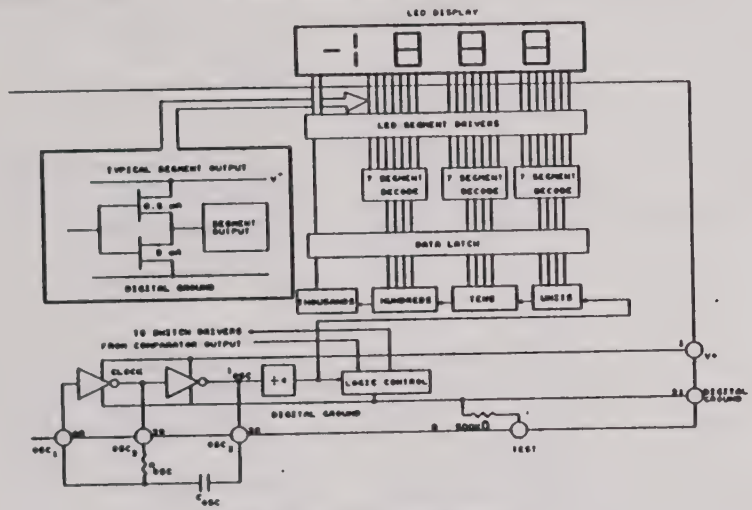


Figure 3. UM7107A Digital Section

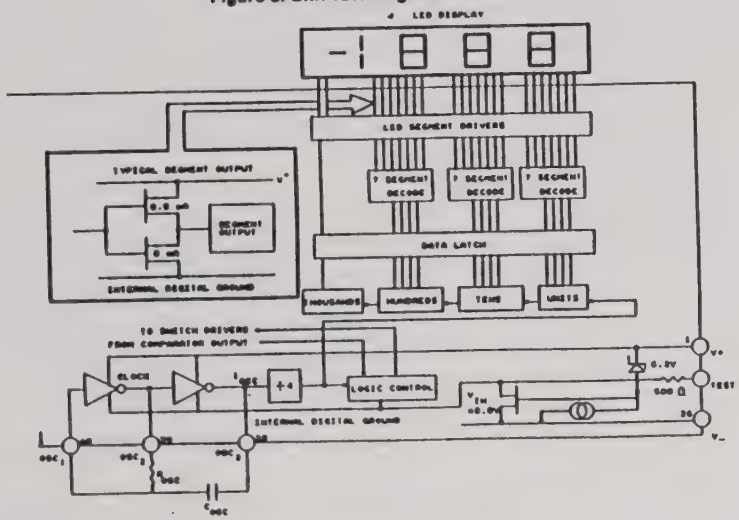
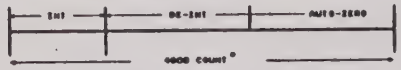


Figure 4. UM7107B Digital Section

System Timing

The oscillator frequency is divided by four before it clocks the decade counters. It is then further divided to form the three convert-cycle phase. These are signal integrated (1000 counts), reference de-integrate (0 to 2000 counts) and auto-zero (1000 to 3000 counts). For signals less than full scale, auto-zero gets the unused portion of reference deintegrate. This makes complete measure cycles of 4000 (16000 clock pulses) independent of input voltage.



* as a matter of fact, the total measurement cycle is 4001 counts for measured values less than 2000 counts. The measurement cycle becomes 4000 counts for overflow measurement.

Clock Circuit:

UM7106/07A/07B may use the following three clocking methods:

1. An external oscillator connected to pin 40.
2. A crystal between pin 39 and pin 40.
3. An RC oscillator using all three pins (pin 38, 39 & 40).

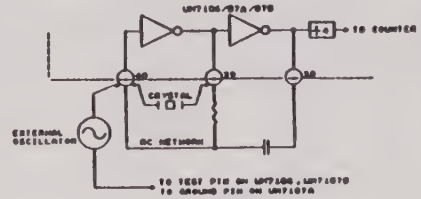


Figure 5. Clock Circuit

To achieve maximum rejection of 50/60 Hz pick up, the signal integrate cycle should be a multiple of 50/60 Hz. The following table describes the selection of oscillator frequencies for 50 or 60Hz respectively.

	Oscillator Frequencies
50Hz	...40KHz, 50KHz, 66$\frac{2}{3}$ KHz, 100KHz.....
60Hz	...33$\frac{1}{3}$ KHz, 40KHz, 48KHz, 60KHz, 80KH 100KHz....

Note that 40KHz (2.5 readings/second) will reject l 50 and 60Hz.

Component Value Selection:

Integrating Resistor (R_{INT}):

The buffer amplifier and integrator are designed class A output stages with 100μA of quiescent c each. They can supply 20μA drive current with gible linearity errors. R_{INT} should be large en to remain in linear-region but small enough to re the leakage current on the PC board.
For a 200mv full scale, R_{INT} is 47KΩ; a 2 volt scale needs a 470KΩ R_{INT}.

Integrating Capacitor (C_{INT}):

C_{INT} should be chosen to give the maximum vol swing without causing the saturation of integ output swing. According to the superior tempera coefficient — 20ppm/ °C of analog common, an common will be normally used as the differe voltage reference. It is fine for a nominal ±2V scale integrator output swing. For three readi second (48KHz clock), a 0.22μF capacitor is sugge If a different oscillator frequency is used, must be changed in inverse proportion to maintain nominal ±2V full scale integrator output swing An additional requirement of C_{INT} is that must have low dielectric absorption to mini rollover error. Polypropylene capacitors give und table errors at reasonable cost.

Reference Voltage Capacitor (C_{REF}):

The reference voltage used to ramp the integrator output voltage back to zero during the reference integrate cycle is stored on C_{REF}. A 0.1μF capacitor gives good performance when V_{IN} is tied to analog common. If a large analog common voltage exists (V_{REF} unequal analog common) and a 200.0mV scale is used, a larger value is required to prevent rollover error. Generally 1.0μF will hold the rollover error to 0.5 count. In this case a mylar type dielectric capacitor is adequate.

Auto-Zero Capacitor (C_{AZ}):

The C_{AZ} value has some influence on system noise. The following combination is recommended:

Application	Adequate C_{AZ}
200.0mV Full Scale	0.47μF
2.000V Full Scale	0.047μF

It is better to use a mylar type capacitor to implement C_{AZ}.

Oscillator Components (Rosc , Cosc):

While using RC oscillator, the Rosc (between pin 39 and pin 40) should be 100KΩ and Cosc is selected from the following equation:

$$Fosc = \frac{0.45}{Rosc \cdot Cosc}$$ (Rosc in MΩ, Cosc in μF)

Reference Voltage Selection:

The analog input required to generate full scale output (2000 counts) is $V_{IN} = 2\ V_{REF}$, thus

Required Full Scale Voltage	V_{REF}
200.0mV	100.0mV
2.000V	1.000V

However, in many applications where A/D converter is connected to a transducer, there may exist a non-unity scale factor between the input voltage and the digital reading. For instance, a pressure transducer output is 400mV for 2000 lb/in^2, rather than dividing the input voltage by two, the V_{REF} should be set to 200.0mV, then permit the transducer input to be used directly.

The differential Voltage reference can also be used to read a digital zero when V_{IN} is not zero. This case is common in temperature measuring instrumentation. A compensating offset Voltage can be applied between analog common and V_{IN}^- and the transducer output is connected between V_{IN}^+ and analog common. The circuit is shown in Figure 6.

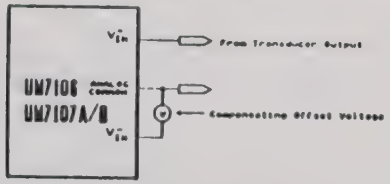


Figure 6. Circuit used to read a digital zero. When V_{IN} is not zero.

An external reference may be added to improve temperature stability; thus, the UM7106/07A/07B devices with lower analog common temperature coefficient may be used. The circuit is shown in Figure 7.

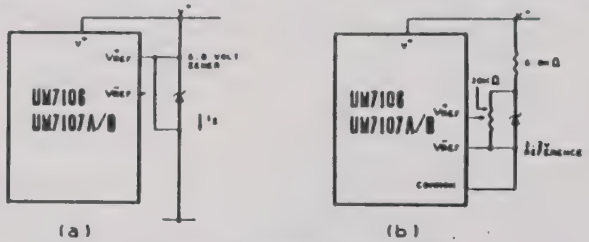


Figure 7. External Reference Voltage Circuits

Application Circuits (for Reference Only)

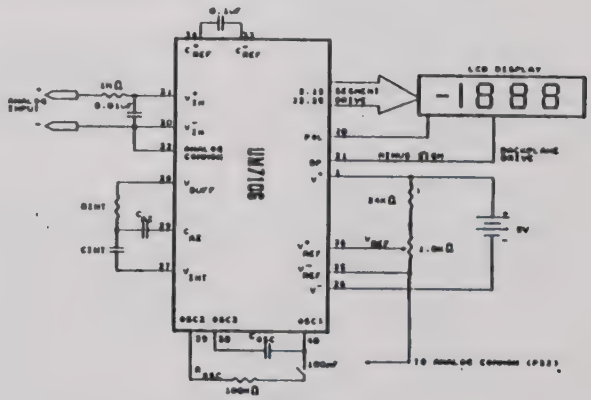


Figure 8

Component Value	Nominal Full-Scale Voltage	
	2.000V	200.0mV
C_{AZ}	0.047μF	0.47μF
R_{INT}	470KΩ	47KΩ
C_{INT}	0.22μF	0.22μF
V_{REF}	1.000V	100.0mV

Application Circuits (Continued)

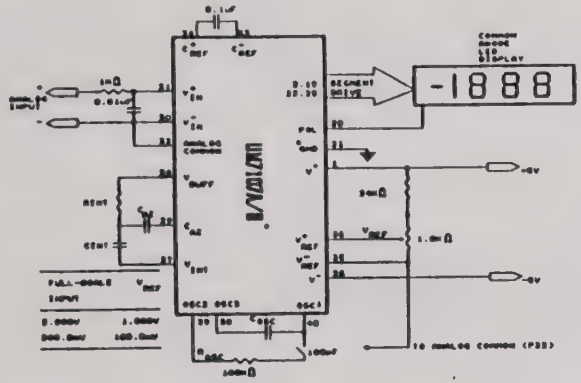


Figure 9

Component Value	Nominal Full-Scale Voltage	
	2.000V	200.0mV
C_{AZ}	0.047μF	0.47μF
R_{INT}	470KΩ	47KΩ
C_{INT}	0.22μF	0.22μF
V_{REF}	1.000V	100.0mV

* Note: For UM7107B, pin21 must be kept floating. Place a 120 Ω resistor between V^- and common anode LED. The digital ground of UM7107B is internally generated in order to improve PCB layout.

Ordering Information

Part No.	Package	Function
UM7106	40L DIP	LCD display
UM7107A/B	40L DIP	LED display

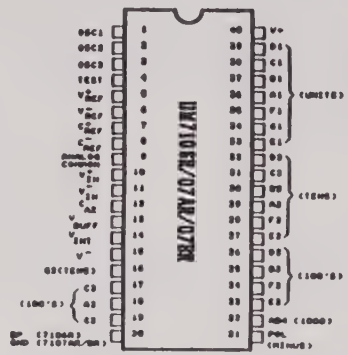
Features

- Guaranteed zero reading with zero input
- True polarity indication for precision null detection
- Low noise
- Convenient 9V battery operation
- Low power operation-10mW
- High impedance CMOS differential inputs $10^{12}\Omega$
- True differential input and reference
- Direct display drive for UM7106R LCD, UM71 LED
- No additional active components required
- Low linearity error: guaranteed less than 1
- Internal reference with low temperature
- Applications: digital panel meters, digi meters, thermometers, capacitance me meters, photometers etc.

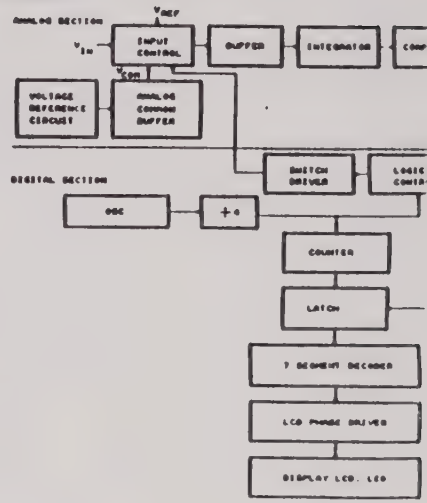
General Description

The UM7106R and UM7107AR/BR are high performance, low power 3 ½-digit A/D converters. All the necessary active devices are contained in a single CMOS IC, including seven-segment decoder,display driver, voltage reference and clock. UM7106R is designed to interface with a liquid crystal display (LCD) and UM7107AR/BR will directly drive an instrument-sized light emitting diode (LED) display. The UM7106R and UM7107AR/BR bring the combination of high accuracy,versa economy. High accuracy, like auto-zero to 100 μV for 2.000V full-scale measurement, or 200.0 mV full-scale measurement, input bias 10pA max, and rollover of less than one co versatility of true differential input and reference is useful in all systems, such gauges or bridge-type tranducers.

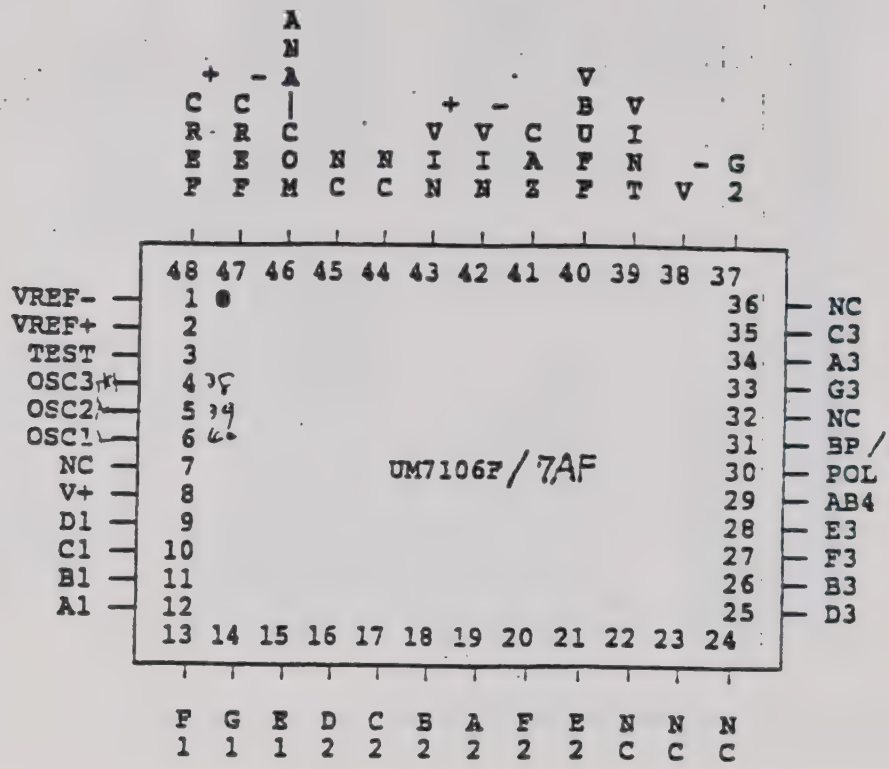
Pin Configuration



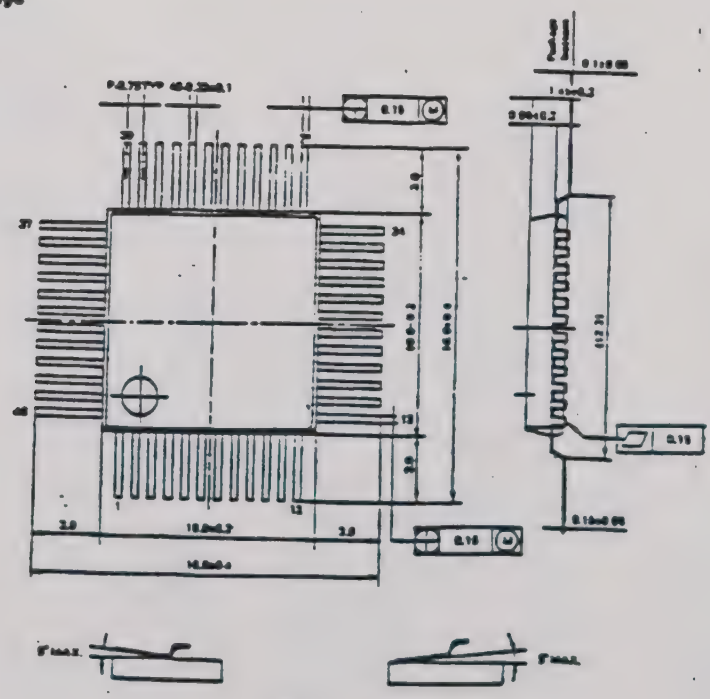
Block Diagram

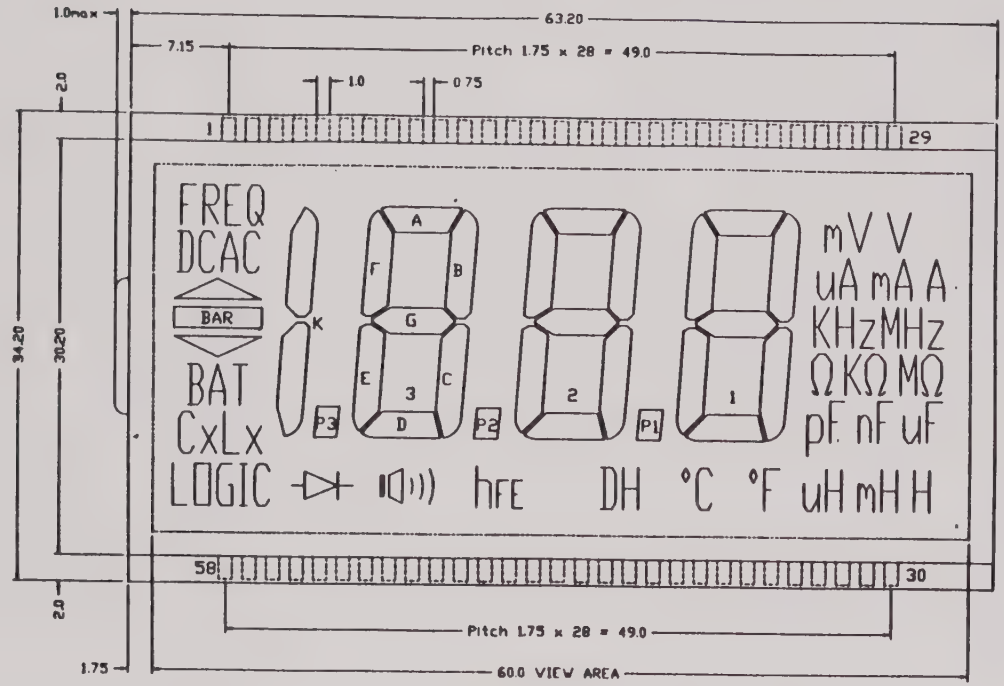


Pin Assignments of UM7106F



48-Lead Flat Package





1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
DC	AC	BAR	BAT	K	3C	P3	3D	3E	3G	3F	3A	3B	hFE	P2	DH	P1	°C	°F	mV	V	uA	mA	A	KHz	MHz	Ω	MΩ	KΩ

30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
COM	uF	nF	pF	H	mH	uH	1A	1B	1C	1D	1E	1G	1F	2A	2B	2C	2D	2E	2G	2F			Lx	Cx	LO GIC			FREQ

Theory of Operation

7108F A/D Converter for DM27xt
Display Layout

Application Circuits (Continued)

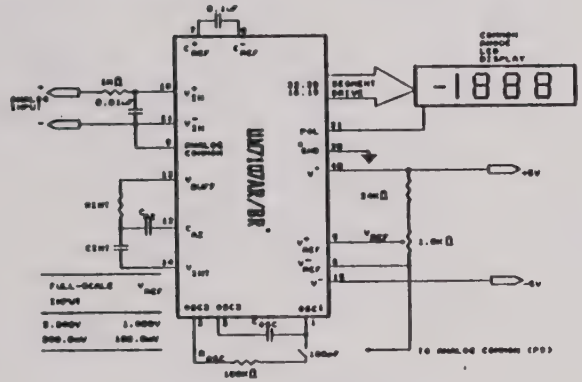


Figure 9

Component Value	Nominal Full-Scale Voltage	
	2.000V	200.0mV
C_{AZ}	0.047μF	0.47μF
R_{INT}	470KΩ	47KΩ
C_{INT}	0.22μF	0.22μF
V_{REF}	1.000V	100.0mV

* Note: For UM7107BR, pin20 must be kept floating. Place a 120 Ω resistor between V+ and common anode LED. The digital ground of UM7107BR is internally generated in order to improve PCB layout.

Ordering Information

Part No.	Package	Function
UM7106R	40L DIP	LCD display
UM7107AR/BR	40L DIP	LED display

One Chip 3 1/2-Digit Digital Mul

Features:

- Multi-function measurement system:
  - Analog to digital converter
  - Data hold and Peak hold, both with LCD annunciators
  - Short circuit beeper with LCD annunciator
  - Low battery detector with LCD annunciator
  - Frequency counter with two LCD annunciators (UM7108F)
- Frequency counter: Auto range from 2 KHz to 20 MHz
- Triplex LCD display
  - Full 3 1/2-Digit Display
  - 8 annunciators — Data-hold, Peak-hold, KHz, MHz, Low-bat, Continuance
  - 1 annunciator drive pin for unit display
  - 3 decimal point drivers with 3 independent control pins
  - Polarity driver
  - Displays "OL" for input overrange
- Provides serial data output for other appl (UM7108F)
- Guaranteed zero reading with zero input
- True polarity indication for precision detection
- Convenient 9V battery operation
- Low power operation — 10mW
- Low noise A/D converter
  - Low noise — 15 μV
  - Differential inputs — 1 pA bias current
  - Differential reference for ratiometric ohms
  - On-chip voltage reference — 20 ppM/°C dri
  - Low linearity error guaranteed less than 1
  - High impedance CMOS differential inputs —
- Applications: digital panel meters, digital meters, thermometers, capacitance meters, pH , photometers etc.

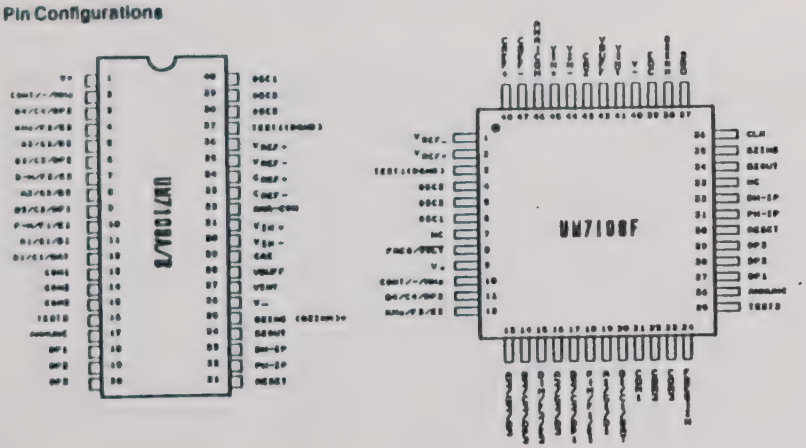
General Description

The UM7108 is a one chip 3 1/2-Digit Digital Multi-meter which combines an integrated A/D converter , peak-hold, data-hold, short circuit beeper and low battery detector in a 40-pin DIP. The UM7108F 48-pin QFP includes a frequency counter, and serial data output.
In UM7108, an autozero cycle guarantees a zero reading with a 0 Volt input. CMOS structure reduces analog input bias current to only 1 pA and low power consumption. Rollover error is less than 1 count. Differential reference inputs permit ratiometric measurements for resistor or bridge transducer applications.

A 'PEAK-HOLD' input allows the UM7108 to hold the highest A/D readout, this feature is useful in measuring the starting current of motors, maximum temperatures and similar applications. However, the 'DATA-HOLD' input allows the UM7108 to hold the current A/D readout or frequency readout. This feature is useful in measuring unstable measurements or in preventing abnormal inputs which may c the measurements.

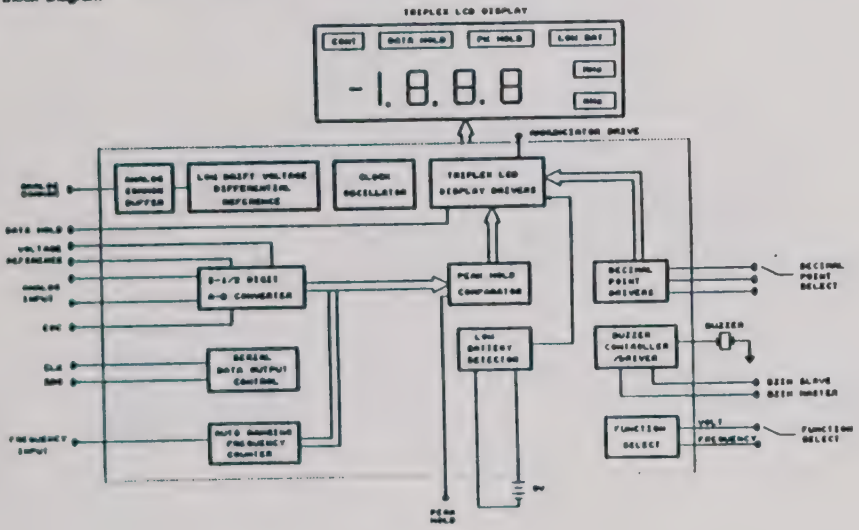
The frequency counter is auto ranging from 2 20 MHz over a five decade range with KHz an annunciators, which are useful in measuring frequencies.
Short circuit beeper will sound whenever the is less than 30 after enabling the short beeper. This feature is useful in detect g circuits without watching the LCD.
The UM7108 provides 3 independent de driving pins for the manufacturer to determine decimal point is displayed, the 3 decima drivers are built-in in UM7108. The UM710 provides one annunciator pin for manufact easily display the unit on LCD. With the features, the total system cost of a 3 1 digital multimeter will be reduced by using U The UM7108 operates from a 9 volt battery, a UM7106, with typical power of 10 mW; and the pa include 40-pin DIP and 48-pin quad flat

Pin Configurations



* Note : Pin 25 [BZINS— UM7108A
BZINM— UM7107B

Block Diagram



Absolute Maximum Ratings*

Supply Voltage (V+ to V-) 15V
Analog Input Voltage (either input) . . . .V+ to V-
Reference Input Voltage (either input) . . .V+ to V-
Clock Input . . . . . Test to V+
Power Dissipation 800mW
Operating Temperature . . . . . .0°C to + 70°C
Storage Temperature . . . .-65°C to + 150°C
Lead Temperature (Soldering, 10 sec) . . . . .260°C

*Comments

Stresses above those listed under "Absolute Maximu Ratings" may cause permanent damage to the devic These are stress ratings only. Functional operation this device at these or any other conditions abo those indicated in the operational sections of th specification is not implied and exposure to absolu maximum rating conditions for extended periods ma affect device reliability.

DC Electrical Characteristics

Unless otherwise noted, specifications apply to UM7108 at Vsupply (V+ to V-) = 9.0V, TA = 25°C, Fclock = 40KHz

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Zero Input Reading	–	-000.0	±000.0	+000.0	Digital Reading	Vin = 0.0V Full Scale = 200.0mV
Ratiometric Reading	–	999	999/1000	1000	Digital Reading	Vin = Vref Vref = 100.0mV
Linearity (Max. Deviation From Best Straight Line Fit)	–	-1	±0.2	+1	Counts	Full Scale 200.0 mV or 2.000V
Noise	VN	–	15	–	µA	Vin = 0V Full Scale 200.0mV
Leakage Current Input	ILEAK	–	1	10	pA	Vin = 0V
Zero Reading Drift	–	–	0.2	1	µV/°C	Vin = 0V 0° < TA < 70°C
Scale Factor Temp Coeff	–	–	1	6	ppm/°C	Vin = 199.0mV 0° < TA < 70°C
Analog Common Voltage (With Respect to Positive Supply)	VANA-COM	2.8	3.0	3.2	V	25KΩ Between Common and Positive Supply
Temp Coeff of Analog Common	–	–	20	50	ppm/°C	25KΩ Between Common and Pos Supply
Common-mode Rejection Ratio	– –	– –	50	200	µV/V	Vcm = 1V, Vin = 0V Full-scale = 200.0mV

DC Electrical Characteristics (Continued)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply Current (Doesn't Include LCD and Com. Current)	Icc	-	1.2	1.8	mA	Is (Vin = 0.0V)
LCD Pk-Pk Segment Drive Voltage	VLCDS	4	5	6	V	
LCD Pk-Pk Back Plane Drive Voltage	VLCDB	4	5	6	V	
Rollover Error	-	-1	±0.2	+1	Counts	Vin+ = Vin- = 200.0mV
Frequency counter Input level	VFRE	V+ - 1.0	-	-	V	Vih(FREQ)
		-	-	DGND+1.0	V	Vil(FREQ)
Low battery margin	VLOW	6.7	7.2	7.7	V	(between V+ to V-)
Input terminal : BZINM, BZINS, PH-IP, DH-IP, RESET, FREQ/ $\overline{VOLT}$, CLK, DP1, DP2, DP3						
Input logic low voltage	Vil	-	-	DGND+1.5	V	
Input logic high voltage	Vih	V+ - 1.5	-	-	V	
Pull down current	Ipd	-	5	-	µA	Vin = V+

AC Characteristics

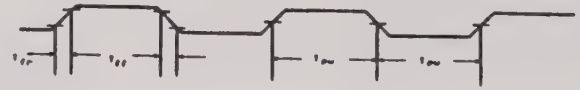
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Peak-hold duration	Tph	0.8	-	-	sec	
PH-IP and DH-IP Keys						
Key debounce time	Tdeb	-	32	38	ms	
Key hold time	Tah	80	-	-	ms	

AC Characteristics (Continued)

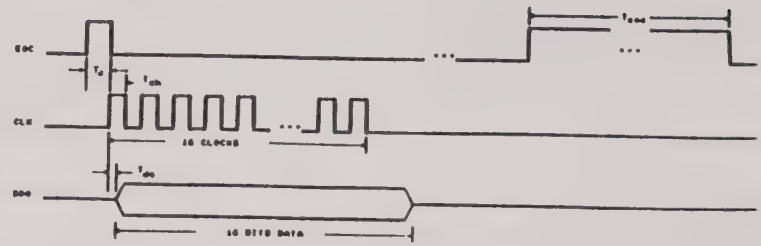
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditio
LCD display frequency	Flcd	-	187	-	Hz	
Operating frequency	Fclock	-	40	-	KHz	
Buzzer drive frequency	Fbzout	-	2.8	-	KHz	
FREQ-IN Waveform Rising Timing	Tfr	-	-	20	ns	
FREQ-IN Waveform Falling Time	Tff	-	-	20	ns	
FREQ-IN Waveform Pulse Width	Tpw	17	-	-	ns	
Clock Delay Time	Td	1	-	5000	µs	
Data Set-up Time	Tds	-	-	500	ns	
EOC Pulse Width	Teoc	-	-	10	ms	
Clock Pulse Width	Tck	500	-	-	ns	

Timing Waveforms

1. Frequency Counter Input Waveform



2. Serial Data Output



Pin Descriptions

Pin No.		Designation	Description
UM7108A/B	UM7108F		
1	9	V+	Positive supply voltage
	7	NC	No connection
	6	FREQ/$\overline{\text{VOLT}}$	Frequency counter/voltage measurement select pin. Connecting to V+ will enable the frequency counter, connecting to TEST1 or open will execute voltage measurement. This pin is internally pulled-down to TEST1
2	10	CONT/- /MHz	LCD segment drive for continuity, polarity and mega-Hz
3	11	B4/C4/DP3	LCD segment drive for "b" and "c" segments of MSD and decimal point 3
4	12	KHz/F3/E3	LCD segment drive for kilo-Hz and " f " and "e" segments of 3rd LSD
5	13	A3/G3/D3	LCD segment drive for "a" , "g" and "d" segments of 3rd LSD
6	14	B3/C3/DP2	LCD segment drive for "b" and "c" segments of 3rd LSD and decimal point 2
7	15	D-H/F2/E2	LCD segment drive for data-hold, " f " and "e" segments of 2nd LSD
8	16	A2/G2/D2	LCD segment drive for "a", "g" and "d" segments of 2nd LSD
9	17	B2/C2/DP1	LCD segment drive for "b" and "c" segments of 2nd LSD and decimal point 1
10	18	P-H/F1/E1	LCD segment drive for peak-hold and " f " and "e" segments of LSD
11	19	A1/G1/D1	LCD segment drive for "a", "g" and "d" segments of LSD
12	20	B1/C1/BAT	LCD segment drive for "b" and "c" segments of LSD and low battery

Pin Descriptions (Continued)

Pin No.		Designation	Description
UM7108A/B	UM7108F		
13	21	COM1	LCD common driver # 1
14	22	COM2	LCD common driver # 2
15	23	COM3	LCD common driver # 3
	24	FREQ - IN	Frequency counter input pin
16	25	TEST2	Test pin, keep floating in normal operation
17	26	ANNUNC	Square wave output at the LCD backplane frequency, synchronized to COM1. Connecting an LCD segment to ANNUNC pin turns it on; connecting to backplane turns it off
18	27	DP1	1st decimal point select input for voltage measurement. This pin is internally pulled-down to TEST1
19	28	DP2	2nd decimal point select input for voltage measurement. This pin is internally pulled -down to TEST1
20	29	DP3	3rd decimal point select input for voltage measurement. This pin is internally pulled -down to TEST1
21	30	RESET	Reset input pin. Connecting to V+ will cancel both Peak-hold and Data-hold functions. This pin is internally pull-down to TEST1

Pin Descriptions (Continued)

Pin No.		Designation	Description
UM7108A/B	UM7108F		
22	31	PH - IP	Peak-hold input pin. Connecting to V+ will make the converter only update the readout if a new conversion value is greater than the preceding value. This pin is a toggle type input pin and is internally pulled-down to TEST1
23	32	DH - IP	Data-hold input pin. Connecting to V+ will make the converter hold the current readout and the converter operation. This pin is a toggle type input pin and is internally pulled-down to TEST1
	33	NC	No connection
24	34	BZOUT	Piezo buzzer output. 2.5 KHz audio frequency output can drive a piezo buzzer 1. Whenever the readout is less than 30 and BZINS is connected to V+ , BZOUT will generate a 2.5 KHz sound output. 2. Whenever the BZINM is connected to V+ it will force the BZOUT to generate a 2.5KHz sound audio output continuously
25 (UM7108A)	35	BZINS	Buzzer control slave input. This pin is internally pulled-down to TEST1. See BZOUT
	36	CLK	External clock input pin for serial data accessing, normally this clock signal is generated by external microcontroller
	37	SDO	Serial data output pin
25 (UM7108B)	38	BZINM	Buzzer control master pin. This pin is internally pulled-down to TEST1. See BZOUT

Pin Descriptions (Continued)

Pin No.		Designation	Description
UM7108A/B	UM7108F		
	39	EOC	End of conversion indicator. When ea conversion ends, this pin will generate positive pulse. Normally, use this sign to interrupt microcontroller
26	40	V -	Negative power supply voltage. Connect to negative terminal of 9V battery
27	41	VINT	Integrator output. Connect to integratio capacitor
28	42	VBUFF	Integration resistor connection.Use a 47k resistor for 200.0 mV full-scale and 470KΩ resistor for 2.000 V full-scale
29	43	CAZ	Autozero capacitor connection.Use a 0.47μ capacitor for 200.0 mV full-scale, and 0.047μF capacitor for 2.000 V full-scale
30	44	V_{IN} -	The analog low input signal is connecte to this pin
31	45	V_{IN}+	The analog high input signal is connecte to this pin
32	46	ANA - COM	This pin is primarily used to set th analog ground reference for battery opera tion or in systems where the input signa is referenced to the power supply
33	47	C_{REF} -	See pin 34
34	48	C_{REF}+	A 0.1μF capacitor is used in most appl cations. If a large common-mode voltag exists and a 200 mV scale is used, a 1.0μ capacitor is recommended which will hol the rollover error to less than 0.5 count
35	1	V_{REF} -	See pin 36

Pin Descriptions (Continued)

Pin No.		Designation	Description
UM7108A/B	UM7108F		
36	2	V_{REF+}	This analog input is required to generate a full-scale output (1,999 counts). Place 100 mV between pin 36 and pin 35 for 200.0 mV full-scale. Place 1.00 V between pin 35 and pin 36 for 2.000 V full-scale
37	3	TEST1(DGND)	Lamp test. When connected to V+ all the segments will be turned on and readout should be 1888. It may also be used as an internal logical ground, nominally 4.7 V below the V+
38	4	OSC3	RC oscillator connection
39	5	OSC2	Crystal oscillator (input) connection
40	6	OSC1	Crystal oscillator (output) connection

Functional Description

An input signal to be measured is applied to the integrating capacitance for a fixed time as determined by a clock counter. The accumulated charge will be proportional to the input signal, for a fixed clock rate and constant current. The resulting integral is returned to zero by integrating a reference signal of polarity opposite that of the input signal. The length of time required for the integrator to return to zero, as measured with the clock counter to display at output, is proportional to the average magnitude of the input signal over the integration period.

A. Analog Section

Fig. 1 shows the block diagram of the Analog Section for UM7108.

Each measurement cycle is divided into three parts. These are : (1) Auto-zero [AZ]
(2) Signal Integration [INT]
(3) Deintegration [DE]

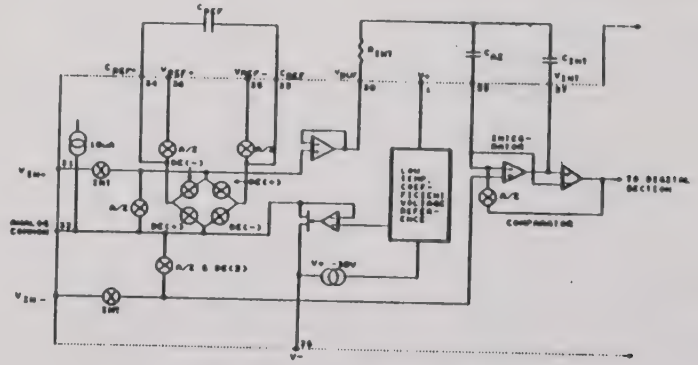


Figure 1. UM7108 Analog Section

1. Auto Zero Phase

During Auto-Zero, three things happen:

(1) V_{IN+} and V_{IN-} are disconnected from pin 30 and 31 and shorted to ANA-COM
(2) The reference capacitor is charged to the reference voltage.
(3) A feedback loop is closed around the system to charge the auto-zero capacitor C_{AZ} to compensate for offset voltages in the buffer amplifier, integrator and comparator.

2. Signal Integrate Phase

During signal integration, the auto-zero loop is opened, the internal short circuit is removed, and the internal inputs high and low are connected to the external pins. The converter then integrates the differential voltage between V_{IN-} and V_{IN+} for a fixed time (1000 counts). At the end of this phase, the polarity of the integrated signal is determined.

3. De-Integrate Phase

The final phase is de-integration, or reference integration. V_{IN-} is internally connected to ANA-COM and V_{IN+} is connected across the previously charged reference capacitor. Circuitry within the chip ensures that the capacitor will be connected with the correct polarity to cause the integrator output to return to zero. The time required to return to zero is proportional to the input signal. Specifically the digital reading displayed is $1000 \left(\frac{A_{IN}}{V_{REF}} \right)$

4. Component Value Selection :

Integrating Resistor (R_{INT})

The buffer amplifier and integrator are designed with class A output stages with 100μA of quiescent current each. They can supply 20μA drive current with negligible linearity errors. R_{INT} should be large enough to remain in linear region but small enough to reduce the leakage current on the PC board.
For 200.0mV full scale, R_{INT} is 47KΩ; at 2.000 V full scale a 470KΩ R_{INT} is needed.

Integrating Capacitor (C_{INT})

C_{INT} should be chosen to give the maximum voltage swing without causing the saturation of integrator output swing. According to the superior temperature coefficient — 20ppm/ °C of analog common, analog common will be normally used as the differential voltage reference. It is fine for a nominal ±2.000V full scale integrator output swing. For 2 1/2 readings/ second (40KHz clock), a 0.22μF capacitor is suggested. If a different oscillator frequency is used, C_{INT} must be changed in inverse proportion to maintain the nominal ±2.000V full scale integrator output swing.
An additional requirement of R_{INT} is that C_{INT} must have low dielectric absorption to minimize rollover error. Polypropylene capacitors give undetectable errors at reasonable cost.

Reference Voltage Capacitor (C_{REF})

The reference voltage used to ramp the integrator output voltage back to zero during the reference integrate cycle is stored on C_{REF}. A 0.1μF capacitor gives good performance when V_{IN}- is tied to analog common. If a large analog common voltage exists (V_{REF}- unequal analog common) and a 200.0mV scale is used, a larger value is required to prevent rollover error.
Generally 1.0μF will hold the rollover error to 0.5 count. In this case a mylar type dielectric capacitor is adequate.

Auto-Zero Capacitor (C_{AZ})

The C_{AZ} value has some influence on system noise. The following combination is recommended:

Application	Adequate C_{AZ}
200.0mV Full Scale	0.47μF
2.000V Full Scale	0.047μF

It is better to use a mylar type capacitor to implement C_{AZ}.

Oscillator Components (R_{OSC}, C_{OSC})

While using RC oscillator, the R_{OSC} (between pin 39 and pin 40) should be 100KΩ and C_{OSC} is selected from the following equation:

$$F_{OSC} = \frac{0.45}{R_{OSC} \times C_{OSC}}$$ (R_{OSC} in MΩ, C_{OSC} in μF)

Reference Voltage Selection

The analog input required to generate full scale output (2000 counts) is $V_{IN} = 2\ V_{REF}$, thus

Required Full Scale Voltage	V_{REF}
200.0mV	100.0mV
2.000V	1.000V

However, in many applications where the A/D converter is connected to a transducer, there may exist a non-unity scale factor between the input voltage and the digital readout. For instance, a pressure transducer output is 400mV for 2000 lb/in^2, rather than dividing the input voltage by two, the V_{REF} should be set to 200.0mV, then permit the transducer input to be used directly.
The differential voltage reference can also be used when a digital zero readout is required when V_{IN} is not zero. This case is common in temperature measuring instrumentation. A compensating offset voltage can be applied between analog common and V_{IN} and the transducer output is connected between V_{IN} and analog common.

B. Digital Section

In the UM7108, the internal digital ground is generated from a 6.2 Volt Zener diode and a large p-channel follower. This supply is made stiff to absorb the relatively large capacitive current when the back plane (BP) is switched. The BP frequency is the clock frequency divided by 240. The segments are driven at the same frequency and amplitude and are in phase with BP when OFF, but out of phase when ON. In all cases, negligible DC voltage exists across the segments.

1. System Timing

The oscillator frequency is divided by four before it clocks the decade counters. It is then further divided to form the three convert-cycle phase. These are signal integrate (1000 counts), reference de-integrate (0 to 2000 counts) and auto-zero (1000 to 3000 counts). For signals less than full scale, auto-zero gets the unused portion of reference de-integrate. This makes complete measure cycles of 4000 (16000 clock pulses) independent of input voltage.
* As a matter of fact, the total measurement cycle is 4001 counts for measured values less than 2000 counts. The measurement cycle becomes 4000 counts for over-flow measurement.

2. Clock Circuit

UM7108A/B/F can use the following three clocking methods:

1. An external oscillator connected to OSC1 PIN.
2. A crystal between OSC2 PIN and OSC1 PIN.
3. An RC oscillator using all three pins (OSC3, OSC2 & OSC1).

To achieve maximum rejection of 50/60 Hz pick up, signal integrate cycle should be a multiple of 50/ Hz, the following table describes the selection oscillator frequencies for 50 or 60 Hz respectiv

	Oscillator Frequencies
50Hz	*..40KHz, 50KHz, 66-$\frac{2}{3}$ KHz, 100KHz.....
60Hz	..33-$\frac{1}{3}$ KHz,* 40KHz, 48KHz, 60KHz, 80KH 100KHz....

*Note that 40KHz (2.5 readings/second) will re both 50 and 60Hz line noise.

3. LCD Display

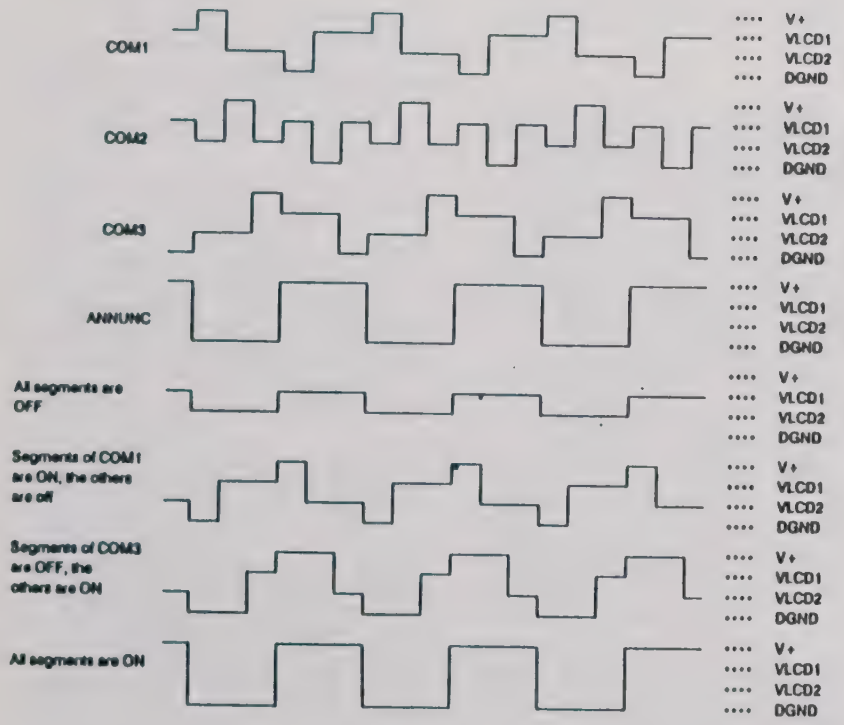
The UM7108A/B/F drives a triplex LCD with th commons. This LCD includes 3 1/2-digits, th decimal, points polarity sign and annunciators peak/hold, data-hold, continuity, frequency and battery. The following figure indicates assignments of the display segments to the comm and segment drive lines.

UM7108A/B Pin No.	UM7108F Pin No.	COM1	COM2	COM3
2	10	CONT	-	MHz
3	11	B4	C4	DP3
4	12	KHz	F3	E3
5	13	A3	G3	D3
6	14	B3	C3	DP2
7	15	D - H	F2	E2
8	16	A2	G2	D2
9	17	B2	C2	DP1
10	18	P - H	F1	E1
11	19	A1	G1	D1
12	20	B1	C1	BAT
13	21	COM1	-	-
14	22	-	COM2	-
15	23	-	-	COM3

The LCD common drive frequency is obtained by dividing the oscillator frequency (Fclock) by 240

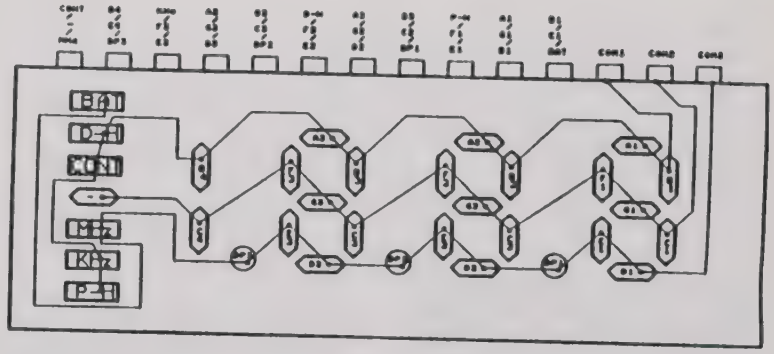
$$F_{lcd} = \frac{F_{clock}}{240}$$

The LCD waveform is as follows

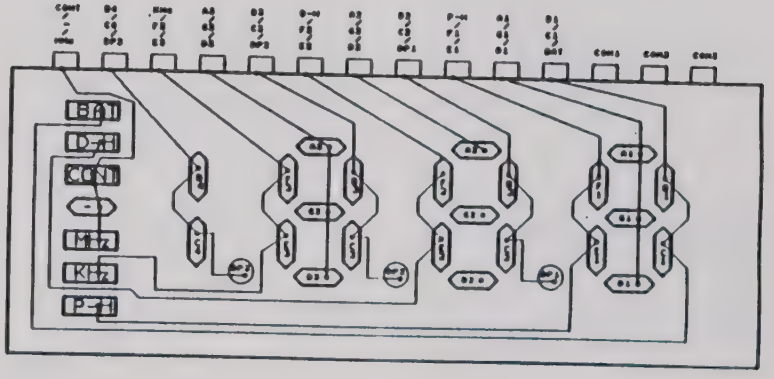


The annunciator output is a square wave running at the LCD backplane frequency (ex. 187Hz for Fclock = 409Hz). The pk-pk amplitude is equal to (V+ - DGND). Connecting an annunciator of the LCD to the ANNUNC pin turns the annunciator on; connecting it to its common turns it off.

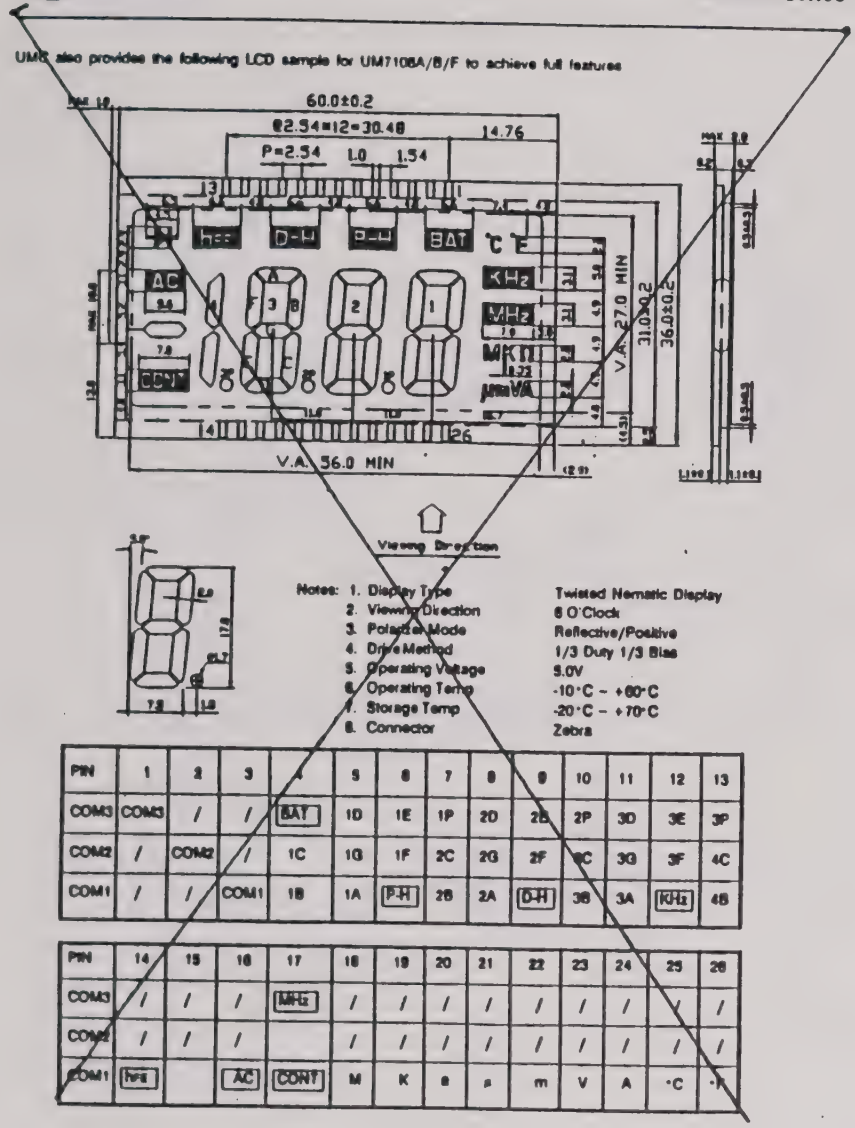
UM7108A/B/F LCD COMMON LAYOUT



UM7108A/B/F LCD SEGMENT LAYOUT



UMC also provides the following LCD sample for UM7108A/B/F to achieve full features



Notes:

1.	Display Type	Twisted Nematic Display
2.	Viewing Direction	6 O'Clock
3.	Polarizer Mode	Reflective/Positive
4.	Drive Method	1/3 Duty 1/3 Bias
5.	Operating Voltage	5.0V
6.	Operating Temp	-10°C ~ +60°C
7.	Storage Temp	-20°C ~ +70°C
8.	Connector	Zebra

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13
COM3	COM3	/	/	BAT	1D	1E	1P	2D	2E	2P	3D	3E	3P
COM2	/	COM2	/	1C	1G	1F	2C	2G	2F	2C	3G	3F	4C
COM1	/	/	COM1	1B	1A	P-H	2B	2A	D-H	3B	3A	KHz	4B

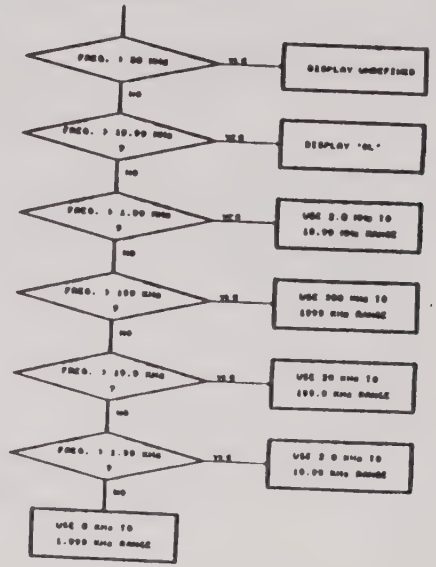
PIN	14	15	16	17	18	19	20	21	22	23	24	25	26
COM3	/	/	/	MHz	/	/	/	/	/	/	/	/	/
COM2	/	/	/		/	/	/	/	/	/	/	/	/
COM1	hFE		AC	CONT	M	K	n	μ	m	V	A	°C	°F

4. Frequency Counter

In addition to serving as an analog-to-digital converter, the UM7108F also provides 2KHz to 20MHz five decade auto-range frequency counter. In the counter mode, pulses at the FREQ-IN will be counted and displayed.
The UM7108F frequency counter derives its time base from the clock oscillator and gets one readout per second. The frequency counter accuracy is determined by the oscillator accuracy. For accurate frequency measurement, a 40KHz quartz crystal oscillator is recommended.
The decimal points are automatically set in frequency mode, the following table indicates the auto-ranging decimal points and annunciators selection versus frequency counter input (Fin).

FREQ-IN	Decimal Point	Annunciator
0KHz to 1.999KHz	DP3	KHz
2.0KHz to 19.99KHz	DP2	KHz
20KHz to 199.9KHz	DP1	KHz
200KHz to 1999KHz	NONE	KHz
2.0MHz to 19.99MHz	DP2	MHz

Auto-Range Frequency Counter Range Selection Algorithm

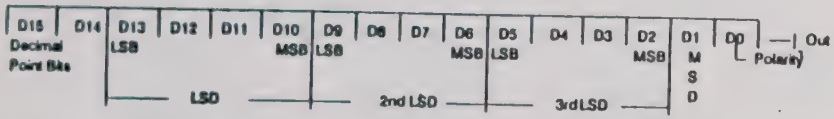


5. Serial Data Output

In addition to the LCD output, the UM7108F provides serial data output for use in connection with micro-controllers. During this operation, UM7108F uses CLK, SDO and EOC pins. The following is the timing diagram of this connection.

The EOC pin will rise HIGH at the end of conversion and the content of serial output data buffer will update simultaneously.
The waveform of EOC pin will go LOW as soon as CLK pin receives clock signal. Otherwise the EOC pin will stay HIGH and then go LOW in 10 ms.

Serial Data Output Format



D0 (Polarity) — '1' —> Plus; '0' —> Minus

D1 (MSD) — '1' —> MSD = 1; '0' —> MSD = 0

D2 to D5 for 3rd LSD (From 0000 TO 1001)
D6 to D9 for 2nd LSD (From 0000 TO 1001)
D10 to D13 for LSD (From 0000 TO 1001)

D14 & D15 for Decimal Point Bits

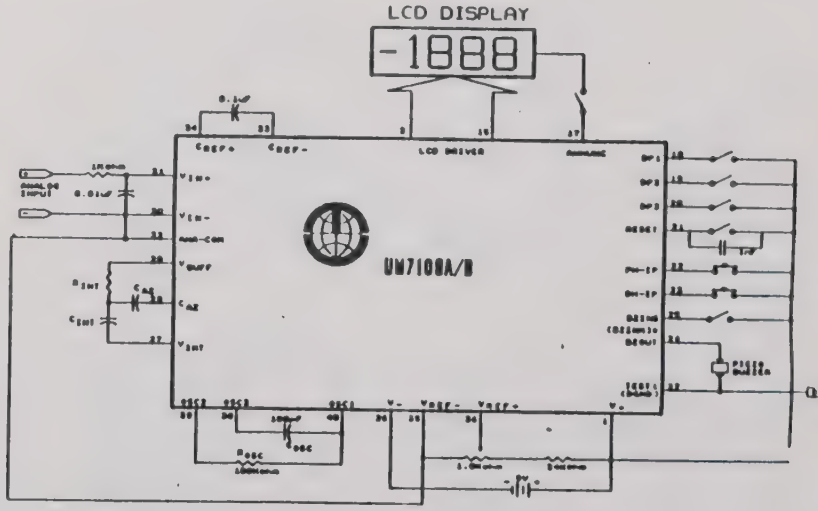
D14	D15	Decimal Point
0	0	None
0	1	DP1
1	0	DP2
1	1	DP3

Special Data Format

Items	D15 ..... D6	D5	D4	D3	D2	D1	D0
(1) Initial State (0000)	Random and don't care	1	1	1	1	1	1
(2) Positive Overflow (OL)		0	0	1	1	1	1
(3) Negative Overflow (- OL)		0	0	1	1	1	0

Application Circuits (for reference only)

(1) For UM7108A/B

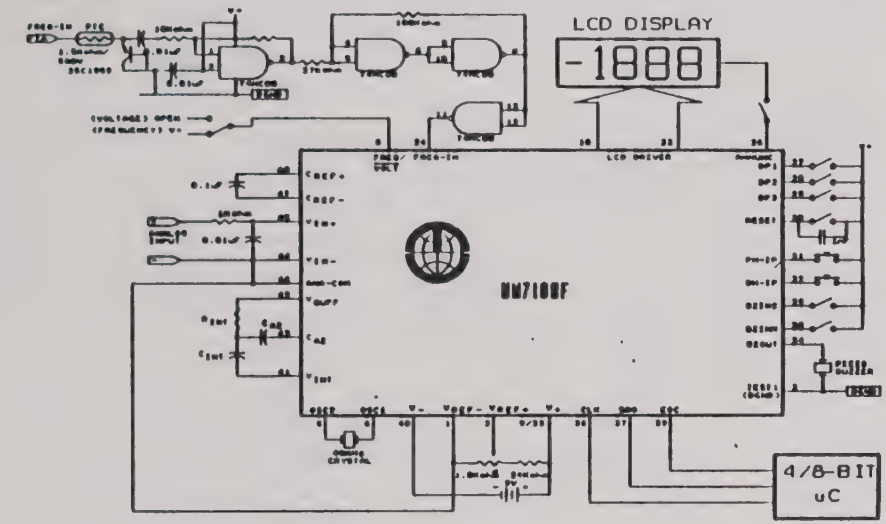


Note : Pin 25 [BZINS— UM7108A
BZINM— UM7108B

Component Value	Nominal Full-Scale Voltage	
	2.000V	200.0mV
C_{AZ}	0.047μF	0.47μF
R_{INT}	470KΩ	47KΩ
C_{INT}	0.22μF	0.22μF
V_{REF}	1.000V	100.0mV

Application Circuits (Continued)

(2) For UM7108F



Component Value	Nominal Full-Scale Voltage	
	2.000V	200.0mV
C_{AZ}	0.047μF	0.47μF
R_{INT}	470KΩ	47KΩ
C_{INT}	0.22μF	0.22μF
V_{REF}	1.000V	100.0mV

Ordering Information

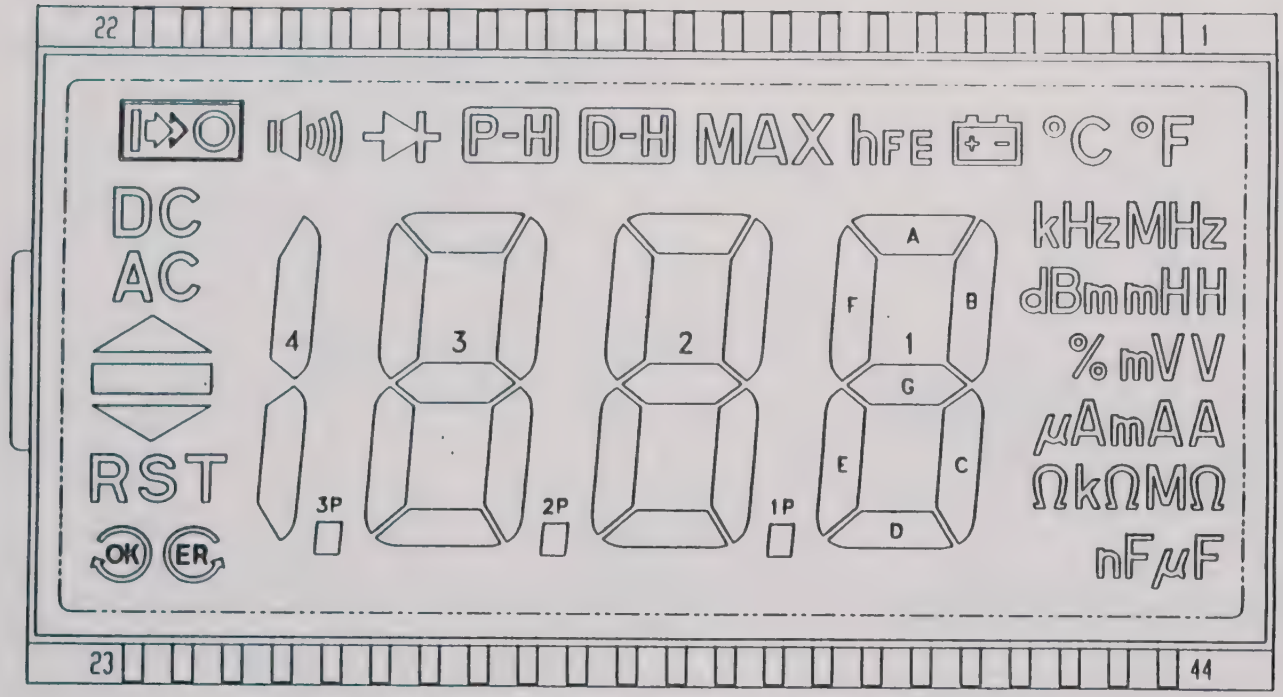
Part No.	Pin Count	Package	Buzzer Input Selection
UM7108A	40 Pin	Plastic DIP	BZINS
UM7108B	40 Pin	Plastic DIP	BZINM
UM7108F	48 Pin	Plastic QFP 48-1	BZINS, BZINM

UMC

General Information

Description

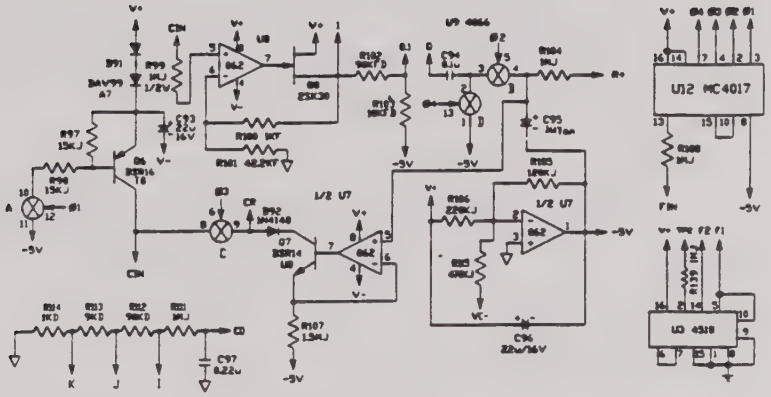
Guide to MOS Handling .....
Quality/Reliability .....
Packaging Information .....



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
COM3			/	/		/	1D	1E	1P	2D	2E	/	2P	/	3D	3E	3P	/	MHz	/	/
	COM2		/	/	1C	/	1G	1F	2C	2G	2F	/	3C	/	3G	3F	4C	/		/	/
		COM1	°F	°C	1B	hFE	1A	MAX	2B	2A	D-H	/	3B	P-H	3A	KHz	4B				DC

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
AC	△	▽	OK	ER	R	S	T	dBm	mH	H	%	mV	V	Ω	KΩ	MΩ	uA	mA	A	nF	uF

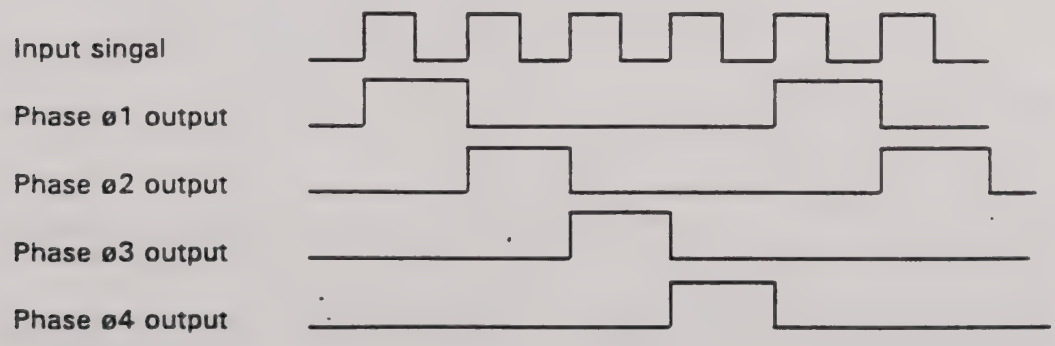
Capacitance Test Circuit



1. The U3 4518 is a divider, the basic clock frequency of which is 32.768kHz. .when the clock signal (32.768kHz) is appplied to U3 pin 2nd (TP2), the f1 and f2 frequency output will be shown as follows:
   f1 = 32.768kHz÷8 = 4.096kHz
   f2 = 32.768kHz÷80 = 409.6Hz

2. Different capacitance measurement ranges should have difference test frequency. To get different clock signal from f1, f2 and TP2 use the rotary switch to select.

   The 4017 split Input waves are as follows:



Capacitance Test Circuit Cont'd...

3. When ø1 Timing, 4066 switches "A" position ON--Q6 ON -- V+ charged unkonwn capacitor Cx. The voltage is Vcx.

4. When ø2 Timing, Vcx voltage transfers to U8 062 opamplifer pin 5th, so Q8, R100, R101 and 062 are attenuated as buffer of the Vcx. R102 and R103 are attenuated by one-tenth decided by range selected. When ø2 Timing -- 4066 "B" Gate ON -- C94 and Cz (A/D IC 1st and 2nd pins) series charged voltage Ratio to Vcx -- $Vc94 + Vc2 = Vcx$ (Ratio).

5. When ø3 Timing, 4066 Gate C will be switched ON. Cx will be discharged the current by CR line (connected select R112, R113 or R114, decided by ranges selected). End ø3 Timing, the discharge will stop, then discharge current value filter by R111 and C97. The voltage value output from C0 connected to A/D IC INHi and INLo. The A/D IC input Hi or Lo voltage value is the Ratio of Vcx-Vcx1 = Vin.
   Vcx is Cx ø1 phase charged voltage.
   Vcx1 is Cx ø3 phase End discharge voltage.
   Vin is Cx discharge voltage send to A/D IC, a ratio to the Cx discharged Electron Quantity Q(discharged).

6. When ø4 timing, CMOS 4066 Gate D will be switched ON. Vcx1, the unknown Capacitor voltage value, will be transfered to C94 by ratio, so Vc94 = Vcx1.

7. ø1 Timing, Cx charged voltage is Vcx.
   ø2 Timing, Vcx = Vc94 + Vc2
   ø3 Timing, Vcx - Vcx1 = Vin = Q (discharged)
   ø4 Timing, Vcx1 = Vc94
   So Vc2 = Vcx - Vc94 = Vcx - Vcx1 = Cx discharged voltage.
   Voltage Vc2 send to A/D IC reference input Hi or Lo.

8. A/D IC Dual slope Method

$$\text{LCD reading} = \frac{\text{Vin (input voltage)}}{\text{VR (Reference Voltage)}} \times 1000$$

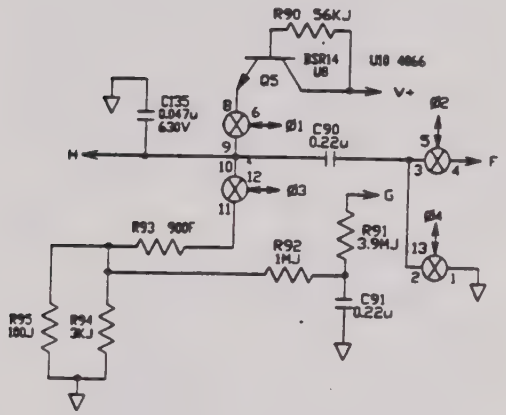
$$= \frac{Q}{Vc2} \times 1000 = C \text{ (value)} = \frac{\Delta Q \text{ (discharge Electron quantity)}}{\Delta V \text{ (discharge voltage)}}$$

$$\text{Because } C = \frac{Q}{V} = \frac{\Delta Q}{\Delta V}$$

9. U7 062 pins (namely 1st, 2nd and 3rd OP AMP), R105 and R106 operate to produce -5V voltage.

10. U7 062 pins (namely 5th, 6th and 7th OP AMP), Q7, R107 and D92 function as 2nF capacitance range Zero adjustment.

2000μF Capacitance Test Circuit



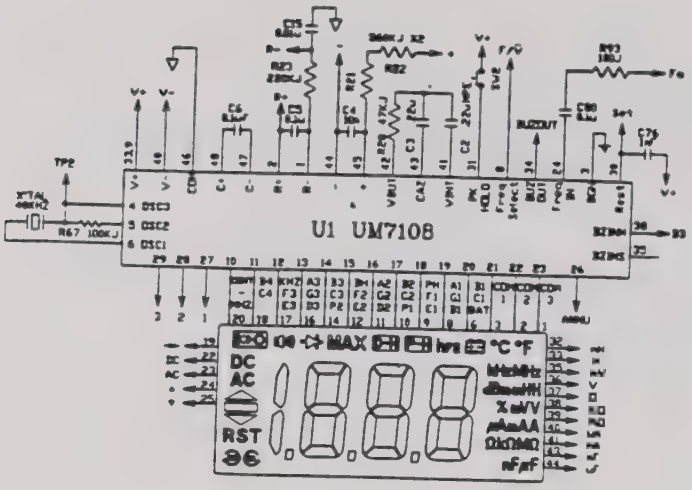
1. The Circuit Theory is the same as the capacitance test circuit.

2. The four phases (ø1, ø2, ø3 and ø4) are produced by U12 (4017).

3. ø1 Timing: Charge Cx. Charged voltage is Vcx
   ø2 Timing: Transfer Vcx = Vc90 + Vc2.
   ø3 Timing: Cx, discharged through R93 and R95, sent the discharge Electron Quantity Ratio to Vin (A/D IC) = Q
   ø4 Timing: transfer Cx End discharge voltage Vcx1 to C90. The Vcx1 = Vc90

4. Zero adjustment is not required.

3½ Digit A/D IC (7108)



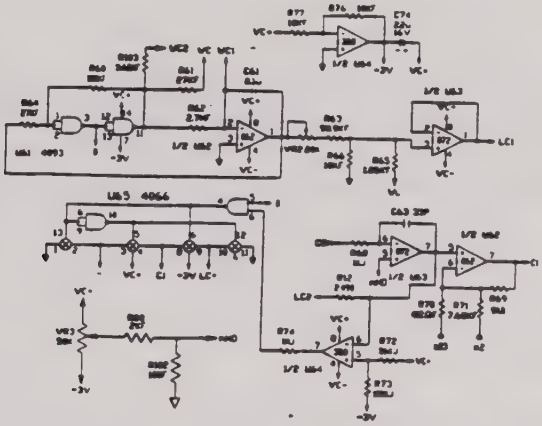
1. UM7108 IC uses Dual Slope Integrate Method.

2. UM7108 linear area is the same as 7106 IC.
   Extra features are:
   a. Frequency Test: autorange from 1Hz resolution to 20MHz.
   b. Low Battery Detector feature (inner).
   c. Decimal point direct drive.
   d. Data Hold and Maximum reading Hold.
   e. Beeper Drive function.

3. LCD consists of triplex drives.

4. For details, please see attached 7108 data sheet.

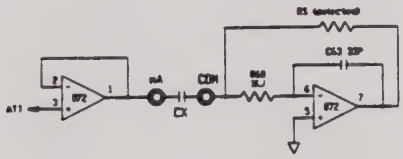
Capacitance & Inductance Test Circuit



1. U61 4093 Gate 1, R60 and R64 constitute Schimitter trigger circuit. R62, C61 and U62 pins (namely 1st, 2nd and 3rd OP AMP) function as Triangle Wave Generator. R103 and R61 are set for the triangle wave frequency value.

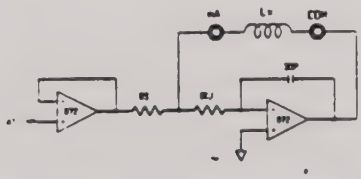
2. VR2, R63 R66 and U63 pins (namely 1st, 2nd, 3rd OP AMP) are wave Attention and Buffer. The function of R65 is to change the Attention value selected.

3. U63 pins (namely 5th, 6th, 7th OP AMP) compose the Test circuit.
   a. Capacitance Test



Use constant voltage test method. R68 is used for input protection. C63 is for damping prevention. Cx is an unknown capacitor. Rs is a standard resistor, selected by using the rotary switch.

b. Inductance Test



Use constant current testing method. Rs is a standard resistor, selected by using the rotary switch. Lx is a value of unknown inductance.

4. U62 pins 5th, 6th, 7th constitute as signal amplifier to select the gain by using the rotary switch to change the values of R69, R70 or R71.

5. U64 pins (namely 5th, 6th, and 7th), R72 and R73 constitute overflow detect circuit.

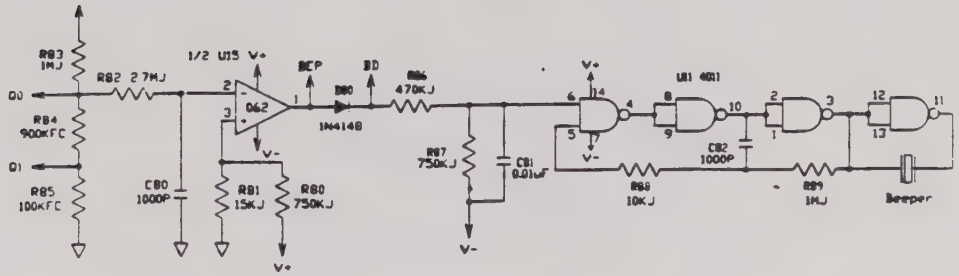
6. U64 pins 1st, 2nd, 3rd function as -3V voltage generator.

7. VR3, R88 and R102 are U63 pins 5th, 6th and 7th (OP AMP) offset adjustment (for 2mH range Zero adjustment).

8. U61 4093 Gates 3rd and 4th are used for Traingle wave 90° and 270° phase angle selection.

9. The test circuit has phase angle detector. The capacitor and Inductor residual resistances will automatically subtract during measurements.

Continuity Test and Beeper Drive Circuit

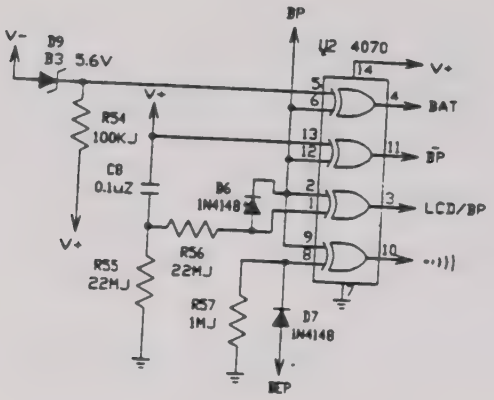


1. R84 and R85 are attenuater resistors for the Diode test function.

2. R80 and R81 together produce a reference voltage. The U15 will compare the input voltage value (Q0) with the reference voltage. If the value of input voltage is below reference voltage, the U15 will emit a high level voltage and drive U11 (4011) oscillator, then beeper sounds.

3. R89 and C82 are essential components for oscillator frequence.

Low Battery Detector and Display Test Circuit



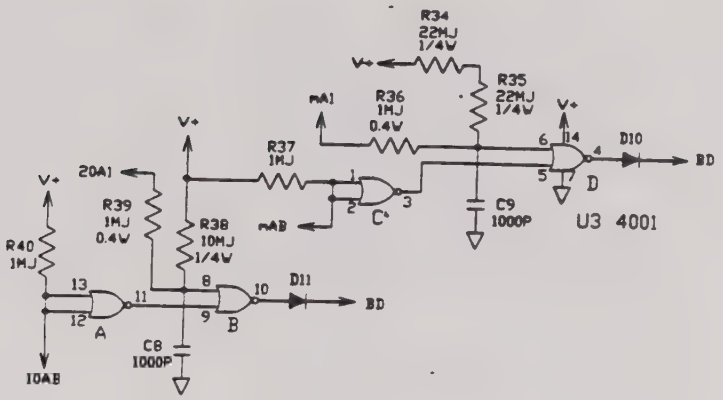
1. D9 and R54 cause Low Battery Detection. When V+ to V- voltage drops below 7V ± 0.5V, the [battery] is displayed.

2. C8, R55, R56 and D6 are application for display test function. The display time is decided by C8 and R55 (1.22 RC).

3. R57 and D7 cause beeper annunciator display on LCD when beeper sounds.

4. BP signal is application for function and unit symbol display control.

Input Warning Detector Circuit

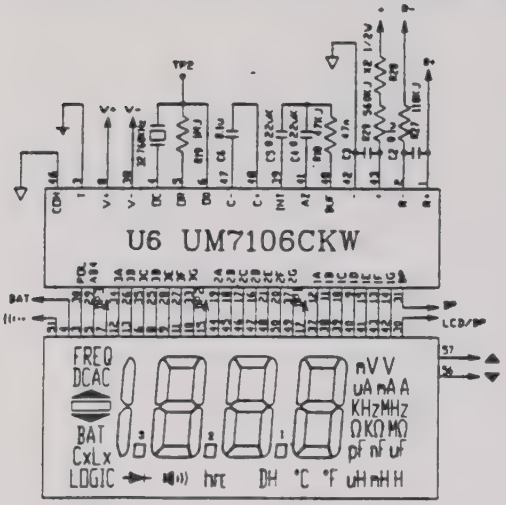


1. The logic Hi and Lo must meet the following:

Input Plug position	Function & Range Switch position	Beeper Status
mA or 10A Jack	mA or 10A Range	Beeper OFF
mA or 10A Jack	Voltage or Ω Range	Beeper ON
Voltage Jack	mA or 10A Range	Beeper OFF
Voltage Jack	Voltage or Ω Range	Beeper OFF

2. U3 4001 CMOS IC
   Gate B is 10A input plug detector (10AI)
   Gate A is 10A Range detector (10AB)
   Gate C is mA Range detector (mAB)
   Gate D is mA input plug detector (mAI)

3½ Digit A/D Converter

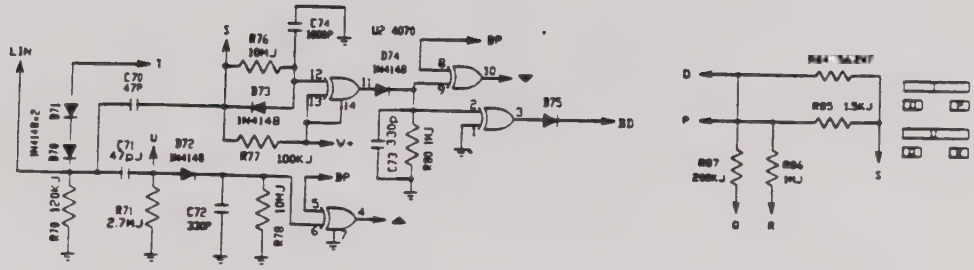


1. 7106CKW is a 44-pin Dual Sloph A/D Converter.

2. LCD is a static drive.

3. For details, please see attached 7106 data sheet.

CMOS, TTL Logic Test Circuit



1. The R84, R87, R85 and R86 are DC bias resistors to U2 (4070). When the rotary switch is set to the R84 and R87, the bias is for the CMOS Logic Test, and when the switch is set to the R85 and R86, the bias is for the TTL Logic test.

2. R77, R84 (R85), D71, D70 and R70 are DC bias components for Logic Low ▼. R87 (R86) and R71 are DC bias components for logic High ▲ .

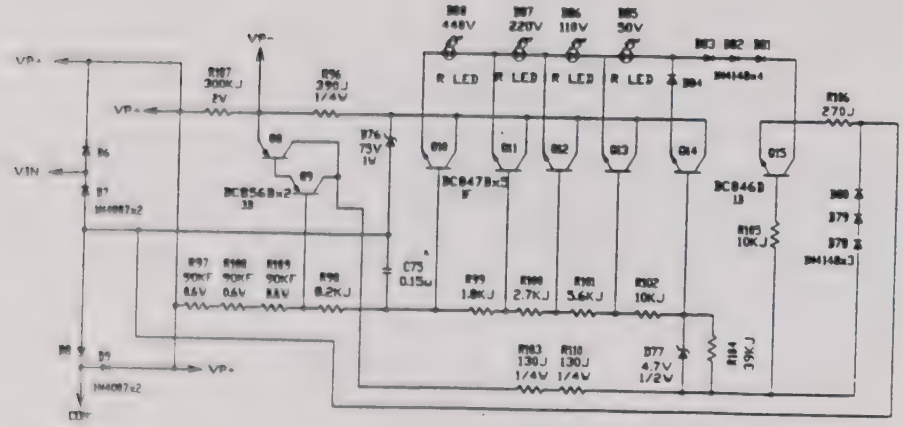
3. C70 and C71 are AC couple capacitors.

4. D72, C72 and R78 are logic High ▲ Hold circuit.

5. D74, C73 and R80 are Logic Low ▼ Hold circuit.

6. D73, R76 and C74 function as Logic high ▲ frequence detector.

Safety Tester Circuit



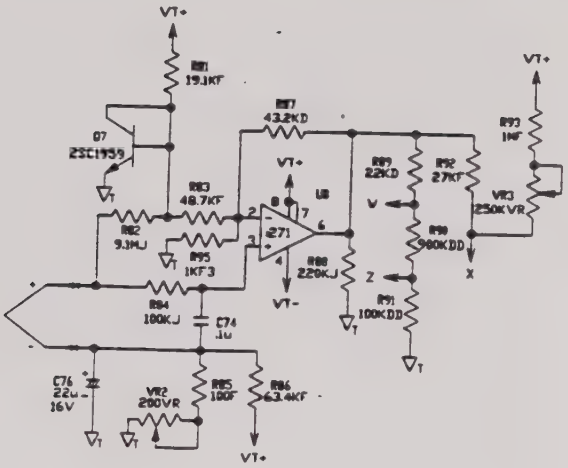
1. D6, D7, D8 and D9 are AC full wave rectifier Diodes.

2. VP+ and VP- are connected to PTC thermistor.

3. R97, R108, R109, R98, R99, R100, R101, R102, R104 and D77 are bias voltage resistors for Q8, Q9, Q10, Q11, Q12,Q13 and Q14.

4. If any value of R98 - R102 resistors is changed, the input voltage value to light the relative LED will be affected too. For example, when value of R98 is 8.2KJ, the D88 LED (440V) will be lighted by 380V input voltage. However, if the value of R98 is changed to be 7.5KJ, the D88 LED will be lighted up with less input voltage value than 380V.

Temperature Converter Circuit



1. U8 TL271 IC is low temperature drift on Input offset voltage about 0.7μV/°C CMOS Input.

2. R81, Q7, R83 and R95 produce cold junction compensation.

3. R86, R85 and VR2 are used for 0°C adjustment.

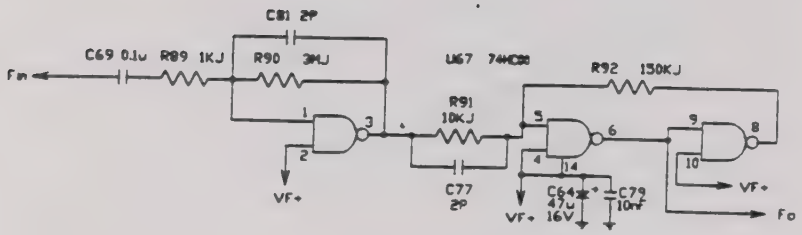
4. R87 and R95 are Linear scale setting. The values of these two resistance should be a match pair.

5. R93, VR3 and R92 is 32.0°F offset adjustment.

6. R89 and R92 are match pair setting for 1°C = 1.8°F scale.

7. R90 and R91 are 0.1°, 1° resolution setting resistors which should be a match pair.

Frequency Amplifier Circuit

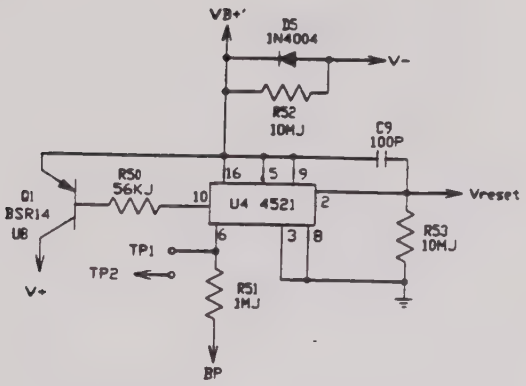


1. C69 is AC couple capacitor. R89 and R90 resistors cause U67 (74HC00 pins 1st, 2nd, 3rd) amplifier Gain. The Gain is 3000.

2. R91 and R92 use Gates 4th, 5th and 6th pins. The 8th, 9th and 10th pins of U67 compose schimitt trigger circuit.

3. The "Fo" output signal is 5V square wave. "Fin" is AC signal input.

Auto-Power Off Circuit



1. U4 (4521) is a 24-stage Frequency divider.

2. U4 Pin 6th is square wave signal input (BP) emitting from A/D converter chip.

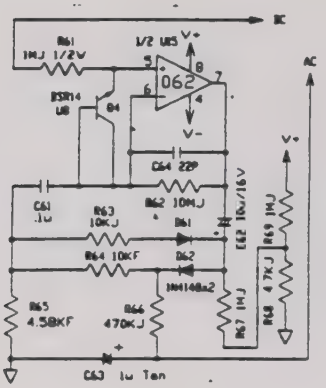
3. U4 pin 10th is a divider by 2^{16}.

4. Power ON, Pin 10th 1s low level -- Q1 ON --Produce V+ voltage --DMM is ON --BP Signal Input to U4 pin 6th.

5. BP signal divider by 2^{16}, when BP singal input to U4 clock to 2^{16}, then U4 pin 10th will go to High level --Q1 OFF-- V+ no voltage --DMM OFF --BP no signal input --U4 pin 10th remains High level.

6. If turn the Function/Range switch; U4 pin 2nd (V reset) will be trigger to high. Reset the divider will restart the Frequency Divider or Continuity Powered ON.

AC to DC Converter Circuit



1. AC Signal (<0.2V AC Sine Wave) applies to U15 (TL062) pin 5th through R61 (1MΩ) Resistor. R61 is a input overload protection resistor.

2. R62 (10MΩ) offers U15 pin 6th input bias current.

3. C61 and C62 are AC couple capacitors.

4. D62 is a AC positive half wave rectifier diode. D61 is a AC negative half wave rectifier diode.

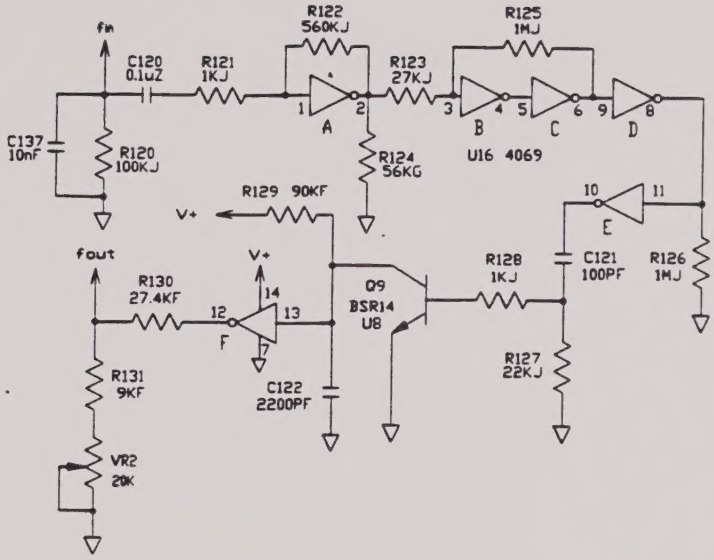
5. R64 (10KΩ) and R65 (4.58KΩ) is a match pair. The ratio is 2.22.

6. R66 (470KΩ) and C63 (1μF) constitute filter circuit.

7. The three resistors, R67, R68 and R69, offer 14mV DC voltage to D61 and D62 to prevent the circuit damping.

8. Q4 Transistor is used for overload signal application (when AC input signal is larger than 200V). Without Q4, the >0.2V DC output singal is unavailable.

2KHz Frequency Test Circuit



1. C137 and R120 are used for signal filter when power source to be tested is larger than 220VAC.

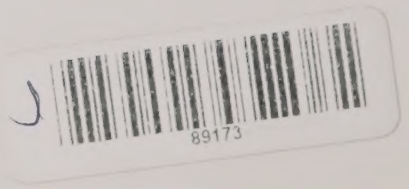
2. C120 as AC couple, R121, R122 and Gate A are signal amplifier. The Gain is 560.

3. R123, R125, and Gate B and C constitute schimmit trigger circuit.

4. C121, R127, R128 and Q9 are differential and trigger circuit.

5. R129 and C122 are for RC chargeing. The pulse width output of Gate F is 1.22RC. For AC signal, one Hz has one pulse output.

6. R130, R131 and VR2 are output adjustment.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